

ASTRONOMICAL PHENOMENA

FOR THE YEAR

2015

Prepared Jointly by
The Nautical Almanac Office
United States Naval Observatory

and

Her Majesty's Nautical Almanac Office
United Kingdom Hydrographic Office

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ASTRONOMICAL PHENOMENA

FOR THE YEAR 2015

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The astronomical data in this booklet are expressed in the scale of universal time (UT); this is also known as Greenwich mean time (GMT) and is the standard time of the Greenwich meridian (0° of longitude). A time in UT may be converted to local mean time by the addition of east longitude (or subtraction of west longitude), where the longitude of the place is expressed in time-measure at the rate of 1 hour for every 15°. The differences between standard times and UT are indicated in the chart on page 22; local clock times may, however, differ from these standard times, especially in summer when clocks are often advanced by 1 hour.

PRINCIPAL PHENOMENA OF SUN AND MOON, 2015

THE SUN

		d	h			d	h	m			d	h	m
Perigee	...	Jan.	4	07	Equinoxes	...	Mar.	20 22 45	...	...	Sept.	23	08 21
Apogee	...	July	6	20	Solstices	...	June	21 16 38	...	...	Dec.	22	04 48

PHASES OF THE MOON

Lunation	New Moon			First Quarter			Full Moon			Last Quarter						
		d	h	m		d	h	m		d	h	m				
1138									Jan.	5	04	53	Jan.	13	09	46
1139	Jan.	20	13	14	Jan.	27	04	48	Feb.	3	23	09	Feb.	12	03	50
1140	Feb.	18	23	47	Feb.	25	17	14	Mar.	5	18	05	Mar.	13	17	48
1141	Mar.	20	09	36	Mar.	27	07	43	Apr.	4	12	06	Apr.	12	03	44
1142	Apr.	18	18	57	Apr.	25	23	55	May	4	03	42	May	11	10	36
1143	May	18	04	13	May	25	17	19	June	2	16	19	June	9	15	42
1144	June	16	14	05	June	24	11	03	July	2	02	20	July	8	20	24
1145	July	16	01	24	July	24	04	04	July	31	10	43	Aug.	7	02	03
1146	Aug.	14	14	53	Aug.	22	19	31	Aug.	29	18	35	Sept.	5	09	54
1147	Sept.	13	06	41	Sept.	21	08	59	Sept.	28	02	50	Oct.	4	21	06
1148	Oct.	13	00	06	Oct.	20	20	31	Oct.	27	12	05	Nov.	3	12	24
1149	Nov.	11	17	47	Nov.	19	06	27	Nov.	25	22	44	Dec.	3	07	40
1150	Dec.	11	10	29	Dec.	18	15	14	Dec.	25	11	11				

ECLIPSES

A total eclipse of the Sun	Mar. 20	Greenland, Iceland, Europe, North Africa and north-western Asia.
A total eclipse of the Moon	Apr. 4	The western half of North America, Oceania, Australasia and eastern Asia.
A partial eclipse of the Sun	Sept. 13	Parts of southern Africa, the southern half of Madagascar, the southern Indian Ocean and the eastern part of Antarctica.
A total eclipse of the Moon	Sept. 28	Western Asia, Africa, Europe, the Americas excluding the western half of Alaska.

For further details see pages 64–76

MOON AT PERIGEE

MOON AT APOGEE

	d	h		d	h		d	h		d	h		d	h
Jan.	21	20	June	10	05	Oct.	26	13	Jan.	9	18	May	26	22
Feb.	19	07	July	5	19	Nov.	23	20	Feb.	6	06	June	23	17
Mar.	19	20	Aug.	2	10	Dec.	21	09	Mar.	5	08	July	21	11
Apr.	17	04	Aug.	30	15				Apr.	1	13	Aug.	18	03
May	15	00	Sept.	28	02				Apr.	29	04	Sept.	14	11

OCCULTATIONS OF PLANETS AND BRIGHT STARS BY THE MOON

Date		Body	Areas of Visibility
d	h		
Jan.	25 12	Uranus	N. half of Africa, S. Europe, Middle East, Russia, N. Asia
Jan.	29 18	<i>Aldebaran</i>	Northernmost Canada
Feb.	21 22	Uranus	North Polynesia, USA except north west, Mexico
Feb.	25 23	<i>Aldebaran</i>	Alaska, N.W. Canada, northernmost Russia, Greenland, Iceland, Scandinavia
Mar.	21 11	Uranus	Easternmost Brazil, Central Africa, Middle East, W. Asia
Mar.	21 22	Mars	Parts of Western Antarctica, S.W. South America
Mar.	25 7	<i>Aldebaran</i>	Kazakhstan, Russia, N.E. Scandinavia, extreme N.E. China, N. Greenland, N.W. Canada, Alaska
Apr.	21 17	<i>Aldebaran</i>	N.W. USA, Canada, Greenland, Iceland, Scandinavia, extreme N. of British Isles, N.W. Russia
Apr.	26 7	Juno	Eastern S.E. Asia, N. Papua New Guinea, Micronesia, N. Melanesia, French Polynesia
May	15 12	Uranus	Central South America, West and Central Africa
June	11 20	Uranus	S. and E. Australia, New Zealand, Fiji, Samoa, French Polynesia
June	15 2	Mercury	S. tip of India, Sri Lanka, most of S.E. Asia, Micronesia
June	15 12	<i>Aldebaran</i>	East and North Canada, Greenland, Iceland, N. Scandinavia, North and central Russia
July	9 3	Uranus	E. parts of Antarctica, S. Indian Ocean, S. tip of Madagascar, westernmost Australia
July	12 18	<i>Aldebaran</i>	N. Japan, E. Russia, Alaska, N. Canada, Greenland, Iceland
July	19 1	Venus	New Guinea, N.E. Australia, Melanesia, French Polynesia
Aug.	5 9	Uranus	Antarctic Peninsula, S. South America, Falkland Islands
Aug.	9 0	<i>Aldebaran</i>	Middle East, E. Europe, N.W. Asia, Scandinavia, Russia, Alaska, N.W. Canada
Sep.	1 16	Uranus	Wilkes Land, Victoria Land, most of New Zealand
Sep.	5 6	<i>Aldebaran</i>	Eastern North America, Europe, western Russia, N.W. Asia
Sep.	29 1	Uranus	Parts of Antarctica, South Africa, S. tip of Madagascar
Oct.	2 13	<i>Aldebaran</i>	Micronesia, Japan, North America
Oct.	8 21	Venus	Australia, E. Melanesia, New Zealand, Victoria Land
Oct.	11 12	Mercury	S. South America, Falkland Islands, parts of Antarctica
Oct.	26 10	Uranus	E. part of Antarctica, New Zealand, S. French Polynesia
Oct.	29 23	<i>Aldebaran</i>	N.W. Africa, Europe, Russia, N. Middle East, N. Asia
Nov.	22 19	Uranus	Queen Maud Land, Enderby Land, southern Indian Ocean
Nov.	26 10	<i>Aldebaran</i>	Japan, Eastern Russia, N. USA, Canada, Greenland
Dec.	6 3	Mars	Central and East Africa, S. Arabian Peninsula, S. tip of India, Indonesia, Australia
Dec.	7 17	Venus	North and Central America, Caribbean
Dec.	20 1	Uranus	Antarctic Peninsula, S. tip of South America, Falkland Islands
Dec.	23 20	<i>Aldebaran</i>	Easternmost coast of Canada, N.W. Africa, Europe, Russia, northern Asia

Maps showing the areas of visibility may be found on AsA-Online.

GEOCENTRIC PHENOMENA

MERCURY

	d	h		d	h		d	h		d	h
Greatest elongation East	Jan.	14 20 (19°)	May	7 05 (21°)	Sept.	4 10 (27°)	Dec.	29 03 (20°)			
Stationary	Jan.	21 04	May	19 11	Sept.	17 13		—			
Inferior conjunction . .	Jan.	30 14	May	30 17	Sept.	30 15		—			
Stationary	Feb.	11 07	June	11 20	Oct.	8 22		—			
Greatest elongation West	Feb.	24 16 (27°)	June	24 17 (22°)	Oct.	16 03 (18°)		—			
Superior conjunction . .	Apr.	10 04	July	23 19	Nov.	17 15		—			

VENUS

		d	h			d	h
Greatest elongation East	June	6	18	(45°)	Stationary	...	Sept. 5 09
Greatest illuminated extent	July	10	04		Greatest illuminated extent	...	Sept. 21 15
Stationary	July	23	06		Greatest elongation West	...	Oct. 26 07 (46°)
Inferior conjunction	Aug.	15	19				

EARTH

	d	h		d	h	m		d	h	m
Perihelion	Jan.	4 07	Equinoxes	Mar.	20 22	45	Sept.	23 08	21	
Aphelion	July	6 20	Solstices	June	21 16	38	Dec.	22 04	48	

SUPERIOR PLANETS

	Conjunction	Stationary	Opposition	Stationary
	d h	d h	d h	d h
Mars	June 14 16	—	—	—
Jupiter	Aug. 26 22	—	Feb. 6 18	Apr. 8 20
Saturn	Nov. 30 00	Mar. 14 22	May 23 02	Aug. 2 20
Uranus	Apr. 6 14	July 26 16	Oct. 12 04	Dec. 26 11
Neptune	Feb. 26 05	June 12 20	Sept. 1 04	Nov. 18 21

The vertical bars indicate where the dates for the planet are not in chronological order.

HELIOCENTRIC PHENOMENA

	Perihelion	Aphelion	Ascending Node	Greatest Lat. North	Descending Node	Greatest Lat. South
Mercury	Jan. 21	Mar. 6	Jan. 17	Feb. 1	Feb. 24	Mar. 27
	Apr. 19	June 2	Apr. 15	Apr. 30	May 23	June 23
	July 16	Aug. 29	July 12	July 27	Aug. 19	Sept. 19
	Oct. 12	Nov. 25	Oct. 8	Oct. 22	Nov. 15	Dec. 15
Venus	Apr. 18	Aug. 8	Mar. 15	May 10	July 5	Jan. 18
	Nov. 29	—	Oct. 26	Dec. 20	—	Aug. 31
Mars	—	Nov. 20	Apr. 12	Oct. 13	—	—

Jupiter, Saturn, Uranus, Neptune: None in 2015

... Continued from page 14 Predicted Perihelion Passages Of Comets, 2015

	T	q(au)	P(y)		T	q(au)	P(y)
141P/Machholz	Aug. 24	0.76	5.25	10P/Tempel	Nov. 14	1.42	5.36
61P/Shajn-Schaldach	Oct. 2	2.11	7.06	230P/LINEAR	Nov. 18	1.49	6.27
151P/Helin	Oct. 8	2.47	13.90	249P/LINEAR	Nov. 26	0.50	4.59
P/2001 H5 (NEAT)	Oct. 21	2.44	15.04	P/2010 R2 (La Sagra)	Nov. 30	2.62	5.45
P/2007 V2 (Hill)	Oct. 23	2.78	8.22	P/2003 WC ₇	Dec. 5	1.66	11.79
P/1994 N2 (McNaught-Hartley)	Oct. 24	2.45	20.61	(LINEAR-Catalina)			
22P/Kopff	Oct. 25	1.56	6.40	P/2002 Q1 (Van Ness)	Dec. 10	1.56	6.73
P/2005 RV ₂₅	Oct. 28	3.58	8.94	204P/LINEAR-NEAT	Dec. 11	1.93	6.99
(LONEOS-Christensen)				180P/NEAT	Dec. 12	2.49	7.58
P/2008 Y2 (Gibbs)	Nov. 5	1.63	6.78	P/1998 QP ₅₄	Dec. 25	1.89	8.62
214P/LINEAR	Nov. 12	1.85	6.87	(LONEOS-Tucker)			

VISIBILITY OF PLANETS

MERCURY can only be seen low in the east before sunrise, or low in the west after sunset (about the time of beginning or end of civil twilight). It is visible in the mornings between the following approximate dates: February 6 to April 1, June 9 to July 16 and October 7 to November 3. The planet is brighter at the end of each period, (the best conditions in northern latitudes occur in mid-October and in southern latitudes from mid-February to mid-March). It is visible in the evenings between the following approximate dates: January 1 to January 24, April 18 to May 21, August 1 to September 24 and December 5 to December 31. The planet is brighter at the beginning of each period, (the best conditions in northern latitudes occur from late April to early May and in southern latitudes from mid-August to mid-September).

VENUS is a brilliant object in the evening sky from the beginning of the year until in the second week of August it becomes too close to the Sun for observation. From the end of the third week of August it reappears in the morning sky where it stays until the end of the year. Venus is in conjunction with Mercury on August 5, with Mars on February 21, August 29 and November 3 and with Jupiter on July 1, July 31 and October 26.

MARS is visible as a reddish object in Capricornus in the evening sky at the beginning of the year. Its eastward elongation gradually decreases as it moves through Aquarius from early January, Pisces from mid-February, briefly into Cetus in early March, then into Pisces again and into Aries in late March. It becomes too close to the Sun for observation in mid-April. It reappears in the morning sky during the first week of August in Gemini and then moves into Cancer in early August, Leo from early September (passing $0^{\circ}8'N$ of *Regulus* on September 24) and into Virgo early in November, where it remains for the rest of the year (passing $4^{\circ}N$ of *Spica* on December 21). Mars is in conjunction with Venus on February 21, August 29 and November 3 and with Jupiter on October 17.

JUPITER can be seen for most of the night in Leo at the beginning of the year. Its westward elongation gradually increases, passes into Cancer in early February, and is at opposition on February 6 when it can be seen throughout the night. Its eastward elongation then gradually decreases and from mid-May it can be seen only in the evening sky. It passes into Leo in the second week of June (passing $0^{\circ}4'N$ of *Regulus* on August 10). In mid-August it becomes too close to the Sun for observation until in the second week of September it reappears in the morning sky in Leo in which constellation it remains for the rest of the year. Its westward elongation gradually increases and by mid-December it can be seen for more than half the night. Jupiter is in conjunction with Venus on July 1, July 31 and October 26, with Mercury on August 7 and with Mars on October 17.

SATURN rises well before sunrise at the beginning of the year in Libra and moves into Scorpius in mid-January. It returns to Libra in the second week of May, is at opposition on May 23 when it can be seen throughout the night, and in mid-October returns to Scorpius. From mid-August until mid-November it can only be seen in the evening sky and then becomes too close to the Sun for observation. It reappears in mid-December in Ophiuchus and is visible only in the morning sky for the remainder of the year.

URANUS is visible at the beginning of the year in the evening sky in Pisces and remains in this constellation throughout the year. In mid-March it becomes too close to the Sun for observation and reappears in late April in the morning sky. Uranus is at opposition on October 12. Its eastward elongation gradually decreases and Uranus can be seen for more than half the night for the remainder of the year.

NEPTUNE is visible at the beginning of the year in the evening sky in Aquarius and remains in this constellation throughout the year. In the first week of February it becomes too close to the Sun for observation and reappears in mid-March in the morning sky. Neptune is at opposition on September 1 and from early December can only be seen in the evening sky.

DO NOT CONFUSE (1) Venus with Mercury in the first three weeks of January, with Mars in mid-February to early March and again in late October to mid-November and with Jupiter in late June to mid-July and again in late October; on all occasions Venus is the brighter object. (2) Jupiter with Mercury in early August and with Mars in October after the first week; on both occasions Jupiter is the brighter object.

VISIBILITY OF PLANETS IN MORNING AND EVENING TWILIGHT

	Morning	Evening
Venus	August 20 – December 31	January 1 – August 11
Mars	August 6 – December 31	January 1 – April 18
Jupiter	January 1 – February 6 September 10 – December 31	February 6 – August 13
Saturn	January 1 – May 23 December 17 – December 31	May 23 – November 13

VISIBILITY OF PLANETS

The planet diagram on page 9 shows, in graphical form for any date during the year, the local mean times of meridian passage of the Sun, of the five planets Mercury, Venus, Mars, Jupiter and Saturn, and of every 2^h of right ascension. Intermediate lines, corresponding to particular stars, may be drawn in by the user if desired. The diagram is intended to provide a general picture of the availability of planets and stars for observation during the year.

On each side of the line marking the time of meridian passage of the Sun, a band 45^m wide is shaded to indicate that planets and most stars crossing the meridian within 45^m of the Sun are generally too close to the Sun for observation.

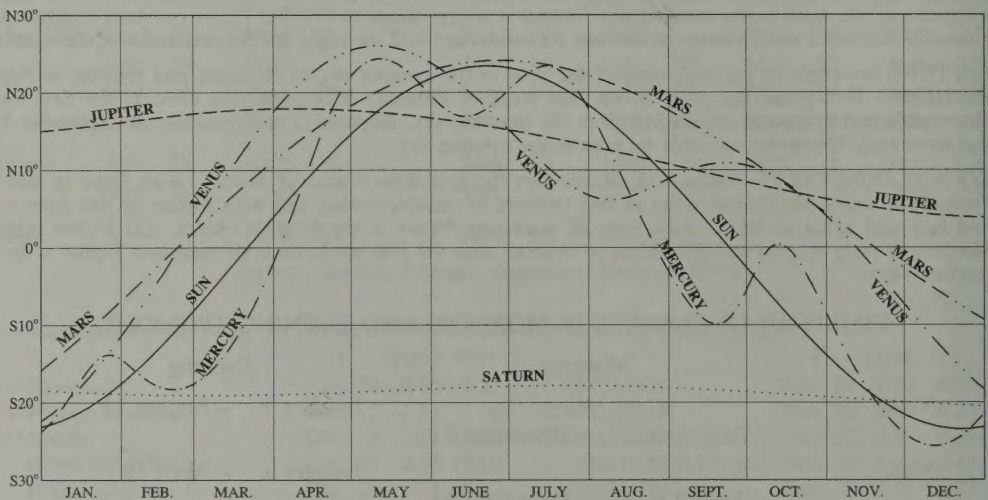
For any date the diagram provides immediately the local mean time of meridian passage of the Sun, planets and stars, and thus the following information:

- whether a planet or star is too close to the Sun for observation;
- visibility of a planet or star in the morning or evening;
- location of a planet or star during twilight;
- proximity of planets to stars or other planets.

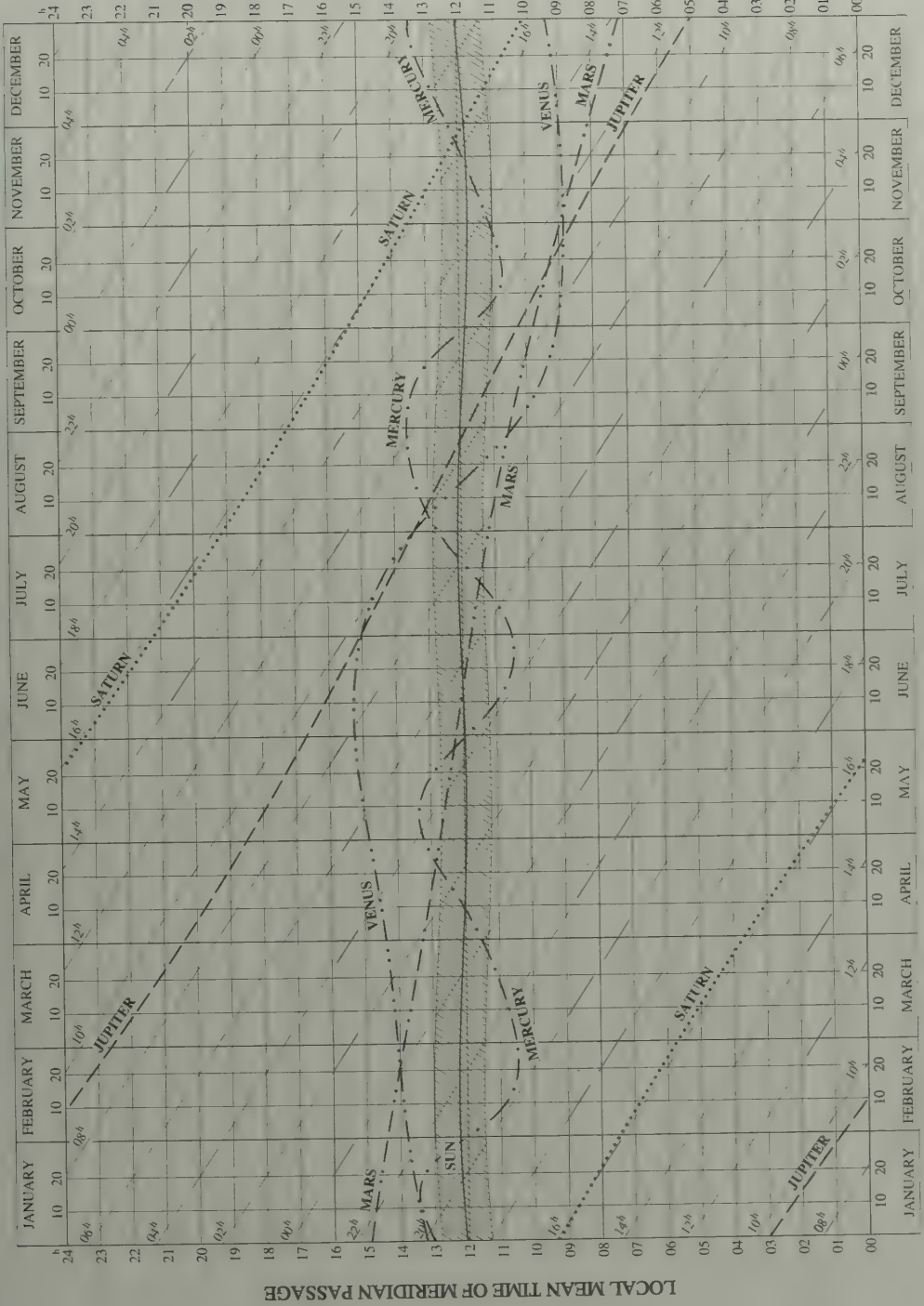
When the meridian passage of a body occurs at midnight, it is close to opposition to the Sun and is visible all night, and may be observed in both morning and evening twilights. As the time of meridian passage decreases, the body ceases to be observable in the morning, but its altitude above the eastern horizon during evening twilight gradually increases until it is on the meridian at evening twilight. From then onwards the body is observable above the western horizon, its altitude at evening twilight gradually decreasing, until it becomes too close to the Sun for observation. When it again becomes visible, it is seen in the morning twilight, low in the east. Its altitude at morning twilight gradually increases until meridian passage occurs at the time of morning twilight, then as the time of meridian passage decreases to 0^h , the body is observable in the west in the morning twilight with a gradually decreasing altitude, until it once again reaches opposition.

Notes on the visibility of the planets are given on page 7. Further information on the visibility of planets may be obtained from the diagram below which shows, in graphical form for any date during the year, the declinations of the bodies plotted on the planet diagram on page 9.

DECLINATION OF SUN AND PLANETS, 2015



LOCAL MEAN TIME OF MERIDIAN PASSAGE



ELONGATIONS AND MAGNITUDES OF PLANETS AT 0^h UT

Mercury					Venus					Mercury					Venus								
Date		Elong.			Mag.			Date		Elong.			Mag.			Date		Elong.			Mag.		
		°								°								°					
Jan.	−2	E.	12	−0.8	E.	16	−3.9	July	2	W.	21	−0.3	E.	42	−4.6	Aug.	27	E.	4	−1.8	E.	27	−4.6
	3	E.	15	−0.8	E.	17	−3.9		7	W.	18	−0.7	E.	41	−4.7		1	E.	9	−1.2	E.	22	−4.4
	8	E.	17	−0.8	E.	18	−3.9		12	W.	13	−1.1	E.	38	−4.7		6	E.	14	−0.7	E.	16	−4.2
	13	E.	19	−0.7	E.	19	−3.9		17	W.	8	−1.6	E.	35	−4.7		11	E.	18	−0.4	E.	10	−4.1
	18	E.	18	−0.4	E.	20	−3.9		22	W.	3	−2.1	E.	32	−4.6		16	E.	21	−0.2	W.	8	−4.1
Feb.	23	E.	14	+0.9	E.	22	−3.9	Sept.	21	E.	23	−0.1	W.	12	−4.1	Oct.	15	E.	24	+0.6	W.	36	−4.8
	28	E.	6	+3.9	E.	23	−3.9		26	E.	25	0.0	W.	17	−4.3		20	E.	19	+1.2	W.	39	−4.8
	2	W.	7	+4.1	E.	24	−3.9		31	E.	27	+0.1	W.	23	−4.5		25	E.	12	+2.8	W.	42	−4.8
	7	W.	16	+1.7	E.	25	−3.9		5	E.	27	+0.1	W.	29	−4.6		30	E.	3	.	W.	43	−4.7
	12	W.	22	+0.6	E.	26	−3.9		10	E.	26	+0.3	W.	33	−4.7		5	W.	9	+3.1	W.	44	−4.7
Mar.	17	W.	25	+0.2	E.	27	−3.9	Nov.	10	W.	15	+0.6	W.	45	−4.7	Dec.	29	E.	7	−0.9	W.	44	−4.2
	22	W.	27	0.0	E.	28	−3.9		15	W.	18	−0.5	W.	46	−4.6		4	E.	9	−0.7	W.	43	−4.2
	27	W.	27	0.0	E.	30	−3.9		20	E.	17	−0.8	W.	46	−4.6		9	E.	12	−0.6	W.	42	−4.2
	4	W.	26	0.0	E.	31	−3.9		25	W.	15	−0.9	W.	46	−4.5		14	E.	14	−0.6	W.	41	−4.1
	9	W.	24	−0.1	E.	32	−3.9		30	W.	12	−1.0	W.	46	−4.5		19	E.	17	−0.6	W.	40	−4.1
Apr.	14	W.	22	−0.2	E.	33	−3.9	July	24	E.	19	−0.7	W.	39	−4.1	Aug.	24	E.	19	−0.7	W.	39	−4.1
	19	W.	19	−0.3	E.	34	−4.0		8	W.	3	−1.9	E.	38	−4.0		29	E.	20	−0.6	W.	39	−4.1
	24	W.	16	−0.5	E.	35	−4.0		13	E.	3	−2.0	E.	39	−4.1		29	E.	20	−0.6	W.	39	−4.1
	29	W.	12	−0.8	E.	36	−4.0		18	E.	9	−1.5	E.	40	−4.1		34	E.	18	−0.2	W.	38	−4.0
	3	W.	8	−1.3	E.	37	−4.0		23	E.	14	−1.1	E.	41	−4.1								
May	8	W.	3	−1.9	E.	38	−4.0	June	28	E.	4	.	E.	45	−4.3	July	22	W.	22	+0.7	E.	44	−4.6
	13	E.	3	−2.0	E.	39	−4.1		2	W.	4	.	E.	45	−4.4		27	W.	22	+0.2	E.	44	−4.6
	18	E.	9	−1.5	E.	40	−4.1		7	W.	11	+3.8	E.	45	−4.4		2	W.	21	−0.3	E.	42	−4.6
	23	E.	14	−1.1	E.	41	−4.1		12	W.	17	+2.4	E.	45	−4.5								
	28	E.	18	−0.7	E.	41	−4.1		17	W.	20	+1.4	E.	45	−4.5								
June	3	E.	20	−0.2	E.	42	−4.2	July	22	W.	22	+0.7	E.	44	−4.6	Aug.	1	E.	9	−1.2	E.	22	−4.4
	8	E.	21	+0.4	E.	43	−4.2		27	W.	22	+0.2	E.	44	−4.6		6	E.	14	−0.7	E.	16	−4.2
	13	E.	20	+1.1	E.	44	−4.2		2	W.	21	−0.3	E.	42	−4.6		11	E.	18	−0.4	E.	10	−4.1
	18	E.	16	+2.2	E.	44	−4.3		7	W.	11	+3.8	E.	45	−4.4		16	E.	21	−0.2	W.	8	−4.1
	23	E.	11	+3.7	E.	45	−4.3		12	W.	17	+2.4	E.	45	−4.5		21	E.	23	−0.1	W.	12	−4.1
July	28	E.	4	.	E.	45	−4.3	Aug.	26	E.	25	0.0	W.	17	−4.3	Sept.	25	E.	12	+2.8	W.	42	−4.8
	2	W.	4	.	E.	45	−4.4		31	E.	27	+0.1	W.	23	−4.5		30	E.	3	.	W.	43	−4.7
	7	W.	11	+3.8	E.	45	−4.4		5	E.	27	+0.1	W.	29	−4.6		5	W.	9	+3.1	W.	44	−4.7
	12	W.	17	+2.4	E.	45	−4.5		10	E.	26	+0.3	W.	33	−4.7		15	E.	24	+0.6	W.	36	−4.8
	17	W.	20	+1.4	E.	45	−4.5		15	W.	18	−0.5	W.	46	−4.6		20	E.	19	+1.2	W.	39	−4.8
August	22	W.	22	+0.7	E.	44	−4.6	Sept.	20	W.	17	−0.8	W.	46	−4.6	Oct.	25	W.	15	−0.9	W.	46	−4.5
	27	W.	22	+0.2	E.	44	−4.6		25	W.	15	−0.9	W.	46	−4.5		30	W.	12	−1.0	W.	46	−4.5
	2	W.	21	−0.3	E.	42	−4.6		30	W.	12	−1.0	W.	46	−4.5		5	W.	9	+3.1	W.	44	−4.7
	7	W.	11	+3.8	E.	45	−4.4		5	E.	27	+0.1	W.	29	−4.6		10	E.	26	+0.3	W.	33	−4.7
	12	W.	17	+2.4	E.	45	−4.5		10	E.	26	+0.3	W.	33	−4.7		15	E.	24	+0.6	W.	36	−4.8
September	17	W.	20	+1.4	E.	45	−4.5	Oct.	15	W.	18	−0.5	W.	46	−4.6	Nov.	20	E.	19	+1.2	W.	39	−4.8
	22	W.	22	+0.7	E.	44	−4.6		20	W.	17	−0.8	W.	46	−4.6		25	E.	12	+2.8	W.	42	−4.8
	27	W.	22	+0.2	E.	44	−4.6		25	W.	15	−0.9	W.	46	−4.5		30	E.	3	.	W.	43	−4.7
	2	W.	21	−0.3	E.	42	−4.6		30	W.	12	−1.0	W.	46	−4.5		5	W.	9	+3.1	W.	44	−4.7
	7	W.	11	+3.8	E.	45	−4.4		5	E.	27	+0.1	W.	29	−4.6		10	E.	26	+0.3	W.	33	−4.7
October	12	W.	17	+2.4	E.	45	−4.5	Nov.	15	W.	18	−0.5	W.	46	−4.6	Dec.	15	E.	24	+0.6	W.	36	−4.8
	17	W.	20	+1.4	E.	45	−4.5		20	W.	17	−0.8	W.	46	−4.6		20	E.	19	+1.2	W.	39	−4.8
	22	W.	22	+0.7	E.	44	−4.6		25	W.	15	−0.9	W.	46	−4.5		25	E.	12	+2.8	W.	42	−4.8
	27	W.	22	+0.2	E.	44	−4.6		30	W.	12	−1.0	W.	46	−4.5		30	E.	3	.	W.	43	−4.7
	2	W.	21	−0.3	E.	42	−4.6		5	E.	27	+0.1	W.	29	−4.6		5	W.	9	+3.1	W.	44	−4.7
November	7	W.	11	+3.8	E.	45	−4.4	Dec.	10	E.	26	+0.3	W.	33	−4.7	Jan.	15	E.	24	+0.6	W.	36	−4.8
	12	W.	17	+2.4	E.	45	−4.5		15	W.	18	−0.5	W.	46	−4.6		20	E.	19	+1.2	W.	39	−4.8
	17	W.	20	+1.4	E.	45	−4.5		20	W.	17	−0.8	W.	46	−4.6		25	E.	12	+2.8	W.	42	−4.8
	22	W.	22	+0.7	E.	44	−4.6		25	W.	15	−0.9	W.	46	−4.5		30	E.	3	.	W.	43	−4.7
	27	W.	22	+0.2	E.	44	−4.6		30	W.	12	−1.0	W.	46	−4.5		5	W.	9	+3.1	W.	44	−4.7
December	2	W.	21	−0.3	E.	42	−4.6	Jan.	5	E.	27	+0.1	W.	29	−4.6	Feb.	10	E.	26	+0.3	W.	33	−4.7
	7	W.	11	+3.8	E.	45	−4.4		10	E.	26	+0.3	W.	33	−4.7		15	E.	24	+0.6	W.	36	−4.8
	12	W.	17	+2.4	E.	45	−4.5		15	W.	18	−0.5	W.	46	−4.6		20	E.	19	+1.2	W.	39	−4.8
	17	W.	20	+1.4	E.	45	−4.5		20	W.	17	−0.8	W.	46	−4.6		25	E.	12	+2.8	W.	42	−4.8
	22	W.	22	+0.7	E.	44	−4.6		25	W.	15	−0.9	W.	46	−4.5		30	E.	3	.	W.	43	−4.7

ELONGATIONS AND MAGNITUDES OF PLANETS AT 0^h UT

Date	Mars		Jupiter		Saturn		Uranus		Neptune	
	Elong.	Mag.	Elong.	Mag.	Elong.	Mag.	Elong.	Mag.	Elong.	Mag.
Jan.	—2	E. 42 +1.1	W. 135 —2.4	W. 37 +0.5	E. 95 +5.8	E. 58 +7.9				
	8	E. 39 +1.1	W. 146 —2.5	W. 46 +0.6	E. 85 +5.8	E. 48 +7.9				
	18	E. 37 +1.2	W. 157 —2.5	W. 55 +0.5	E. 75 +5.9	E. 38 +8.0				
	28	E. 34 +1.2	W. 169 —2.6	W. 65 +0.5	E. 65 +5.9	E. 28 +8.0				
Feb.	7	E. 32 +1.2	E. 179 —2.6	W. 74 +0.5	E. 56 +5.9	E. 19 +8.0				
	17	E. 30 +1.2	E. 168 —2.6	W. 84 +0.5	E. 46 +5.9	E. 9 +8.0				
Mar.	27	E. 27 +1.3	E. 157 —2.5	W. 93 +0.5	E. 36 +5.9	W. 1 +8.0				
	9	E. 25 +1.3	E. 146 —2.5	W. 103 +0.4	E. 27 +5.9	W. 10 +8.0				
	19	E. 22 +1.3	E. 135 —2.4	W. 113 +0.4	E. 17 +5.9	W. 20 +8.0				
	29	E. 20 +1.4	E. 125 —2.3	W. 123 +0.3	E. 8 +5.9	W. 30 +8.0				
Apr.	8	E. 18 +1.4	E. 115 —2.3	W. 133 +0.3	W. 1 +5.9	W. 39 +8.0				
	18	E. 15 +1.4	E. 105 —2.2	W. 144 +0.2	W. 11 +5.9	W. 49 +7.9				
	28	E. 13 +1.4	E. 96 —2.1	W. 154 +0.1	W. 20 +5.9	W. 58 +7.9				
May	8	E. 10 +1.5	E. 87 —2.1	W. 164 +0.1	W. 29 +5.9	W. 68 +7.9				
	18	E. 7 +1.5	E. 78 —2.0	W. 174 0.0	W. 38 +5.9	W. 77 +7.9				
June	28	E. 5 +1.5	E. 70 —1.9	E. 174 0.0	W. 47 +5.9	W. 87 +7.9				
	7	E. 2 +1.5	E. 62 —1.9	E. 164 +0.1	W. 56 +5.9	W. 96 +7.9				
	17	W. 1 +1.5	E. 54 —1.8	E. 154 +0.2	W. 66 +5.9	W. 106 +7.9				
	27	W. 3 +1.6	E. 46 —1.8	E. 144 +0.2	W. 75 +5.9	W. 115 +7.9				
July	7	W. 6 +1.6	E. 38 —1.8	E. 134 +0.3	W. 84 +5.8	W. 125 +7.9				
	17	W. 9 +1.6	E. 31 —1.7	E. 124 +0.3	W. 94 +5.8	W. 135 +7.8				
Aug.	27	W. 12 +1.7	E. 23 —1.7	E. 115 +0.4	W. 103 +5.8	W. 144 +7.8				
	6	W. 15 +1.7	E. 16 —1.7	E. 105 +0.4	W. 113 +5.8	W. 154 +7.8				
	16	W. 18 +1.7	E. 8 —1.7	E. 96 +0.5	W. 123 +5.8	W. 164 +7.8				
	26	W. 22 +1.8	E. 1 —1.7	E. 86 +0.5	W. 132 +5.7	W. 174 +7.8				
Sept.	5	W. 25 +1.8	W. 7 —1.7	E. 77 +0.5	W. 142 +5.7	E. 176 +7.8				
	15	W. 28 +1.8	W. 14 —1.7	E. 68 +0.6	W. 152 +5.7	E. 166 +7.8				
	25	W. 32 +1.8	W. 22 —1.7	E. 59 +0.6	W. 162 +5.7	E. 156 +7.8				
Oct.	5	W. 35 +1.8	W. 30 —1.7	E. 50 +0.6	W. 173 +5.7	E. 146 +7.8				
	15	W. 39 +1.8	W. 38 —1.8	E. 41 +0.6	E. 177 +5.7	E. 136 +7.8				
Nov.	25	W. 43 +1.7	W. 46 —1.8	E. 32 +0.5	E. 167 +5.7	E. 126 +7.9				
	4	W. 47 +1.7	W. 54 —1.8	E. 23 +0.5	E. 156 +5.7	E. 116 +7.9				
	14	W. 51 +1.6	W. 62 —1.9	E. 14 +0.5	E. 146 +5.7	E. 106 +7.9				
	24	W. 55 +1.6	W. 71 —1.9	E. 6 +0.5	E. 136 +5.7	E. 96 +7.9				
Dec.	4	W. 59 +1.5	W. 80 —2.0	W. 4 +0.4	E. 125 +5.8	E. 86 +7.9				
	14	W. 63 +1.4	W. 89 —2.0	W. 13 +0.5	E. 115 +5.8	E. 76 +7.9				
	24	W. 68 +1.3	W. 99 —2.1	W. 22 +0.5	E. 105 +5.8	E. 66 +7.9				
	34	W. 72 +1.2	W. 109 —2.2	W. 31 +0.5	E. 95 +5.8	E. 56 +7.9				

VISUAL MAGNITUDES OF SELECTED DWARF & MINOR PLANETS

	Jan. 8	Feb. 17	Mar. 29	May 8	June 17	July 27	Sept. 5	Oct. 15	Nov. 24	Dec. 34
Ceres	9.0	9.2	9.1	8.7	8.1	7.5	8.2	8.9	9.2	9.3
Pallas	10.0	9.9	9.7	9.5	9.4	9.7	10.1	10.4	10.5	10.5
Juno	8.3	8.5	9.5	10.2	10.7	10.9	10.9	11.0	11.2	11.2
Vesta	7.5	7.8	8.0	7.9	7.7	7.2	6.5	6.5	7.3	8.0
Pluto	14.2	14.2	14.2	14.1	14.1	14.1	14.1	14.2	14.2	14.2

CONFIGURATIONS OF SUN, MOON AND PLANETS

	d	h			d	h		
Jan.	4	00	Pluto in conjunction with Sun		Mar.	14	22	Saturn stationary
	4	07	Earth at perihelion			19	02	Neptune 4° S. of Moon
	5	05	FULL MOON			19	05	Mercury 5° S. of Moon
	8	08	Jupiter 5° N. of Moon			19	20	Moon at perigee
	9	18	Moon at apogee			20	10	NEW MOON Eclipse
	11	06	Vesta in conjunction with Sun			20	23	Equinox
	13	10	LAST QUARTER			21	11	Uranus 0°1 S. of Moon Occn.
	14	20	Mercury greatest elong. E. (19°)			21	22	Mars 1°0 N. of Moon Occn.
	16	12	Saturn 1°9 S. of Moon			22	20	Venus 3° N. of Moon
	19	21	Mars 0°2 S. of Neptune			25	07	Aldebaran 0°9 S. of Moon Occn.
	20	13	NEW MOON			27	08	FIRST QUARTER
	21	04	Mercury stationary			30	10	Jupiter 6° N. of Moon
	21	18	Mercury 3° S. of Moon	Apr.	1	13	Moon at apogee	
	21	20	Moon at perigee			4	12	FULL MOON Eclipse
	22	05	Venus 6° S. of Moon			6	14	Uranus in conjunction with Sun
	23	01	Neptune 4° S. of Moon			8	13	Saturn 2° S. of Moon
	23	05	Mars 4° S. of Moon			8	20	Jupiter stationary
	25	12	Uranus 0°6 S. of Moon Occn.			10	04	Mercury in superior conjunction
	27	05	FIRST QUARTER			12	04	LAST QUARTER
	29	18	Aldebaran 1°2 S. of Moon Occn.			15	13	Neptune 4° S. of Moon
	29	23	Juno at opposition			17	04	Moon at perigee
	30	14	Mercury in inferior conjunction			17	07	Pluto stationary
Feb.	1	11	Venus 0°8 S. of Neptune			18	19	NEW MOON
	3	23	FULL MOON			19	23	Pallas stationary
	4	09	Jupiter 5° N. of Moon			21	04	Venus 7° N. of Aldebaran
	6	06	Moon at apogee			21	17	Aldebaran 0°9 S. of Moon Occn.
	6	18	Jupiter at opposition			21	18	Venus 7° N. of Moon
	11	07	Mercury stationary			26	00	FIRST QUARTER
	12	04	LAST QUARTER			26	07	Juno 0°1 N. of Moon Occn.
	13	00	Saturn 2° S. of Moon			26	18	Jupiter 5° N. of Moon
	17	06	Mercury 3° S. of Moon			29	04	Moon at apogee
	19	00	NEW MOON	May	4	04	FULL MOON	
	19	07	Moon at perigee			5	16	Saturn 2° S. of Moon
	21	01	Mars 1°5 S. of Moon			7	05	Mercury greatest elong. E. (21°)
	21	01	Venus 2° S. of Moon			11	11	LAST QUARTER
	21	20	Venus 0°5 S. of Mars			12	01	Mercury 8° N. of Aldebaran
	21	22	Uranus 0°3 S. of Moon Occn.			12	21	Neptune 3° S. of Moon
	24	16	Mercury greatest elong. W. (27°)			15	00	Moon at perigee
	25	17	FIRST QUARTER			15	12	Uranus 0°2 N. of Moon Occn.
	25	23	Aldebaran 1°0 S. of Moon Occn.			18	04	NEW MOON
	26	05	Neptune in conjunction with Sun			19	07	Mercury 6° N. of Moon
Mar.	3	08	Jupiter 5° N. of Moon			19	11	Mercury stationary
	4	20	Venus 0°1 N. of Uranus			21	19	Venus 8° N. of Moon
	5	08	Moon at apogee			23	02	Saturn at opposition
	5	18	FULL MOON			24	07	Jupiter 5° N. of Moon
	9	15	Juno stationary			25	17	FIRST QUARTER
	11	20	Mars 0°3 N. of Uranus					
	12	08	Saturn 2° S. of Moon					
	13	18	LAST QUARTER					

CONFIGURATIONS OF SUN, MOON AND PLANETS

	d	h				d	h			
May	26	22	Moon at apogee			Aug.	2	20	Saturn stationary	
	30	17	Mercury in inferior conjunction				5	09	Mercury 8° N. of Venus	
	30	17	Venus 4° S. of <i>Pollux</i>				5	09	Uranus 1°0 N. of Moon	Occn.
June	1	20	Saturn 1°9 S. of Moon				7	02	LAST QUARTER	
	2	16	FULL MOON				7	04	Mercury 0°6 N. of Jupiter	
	6	18	Venus greatest elong. E. (45°)				7	15	Mercury 1°0 N. of <i>Regulus</i>	
	6	22	Ceres stationary				8	12	Pallas stationary	
	9	03	Neptune 3° S. of Moon				9	00	<i>Aldebaran</i> 0°7 S. of Moon	Occn.
	9	16	LAST QUARTER				10	23	Jupiter 0°4 N. of <i>Regulus</i>	
	10	05	Moon at perigee				13	05	Mars 6° N. of Moon	
	11	20	Mercury stationary				14	15	NEW MOON	
	11	20	Uranus 0°5 N. of Moon	Occn.			15	19	Venus in inferior conjunction	
	12	01	Pallas at opposition				16	06	Vesta stationary	
	12	20	Neptune stationary				16	15	Mercury 2° N. of Moon	
	14	16	Mars in conjunction with Sun				18	03	Moon at apogee	
	15	02	Mercury 0°04 N. of Moon	Occn.			22	17	Saturn 3° S. of Moon	
	15	12	<i>Aldebaran</i> 1°0 S. of Moon	Occn.			22	20	FIRST QUARTER	
	16	14	NEW MOON				26	22	Jupiter in conjunction with Sun	
	20	11	Venus 6° N. of Moon				29	05	Venus 9° S. of Mars	
	21	00	Jupiter 5° N. of Moon				29	19	FULL MOON	
	21	17	Solstice				30	00	Neptune 3° S. of Moon	
	23	17	Moon at apogee				30	15	Moon at perigee	
	24	08	Mercury 2° N. of <i>Aldebaran</i>			Sept.	1	04	Neptune at opposition	
	24	11	FIRST QUARTER				1	16	Uranus 1°1 N. of Moon	Occn.
	24	17	Mercury greatest elong. W. (22°)				4	10	Mercury greatest elong. E. (27°)	
	29	01	Saturn 2° S. of Moon				5	06	<i>Aldebaran</i> 0°5 S. of Moon	Occn.
July	1	14	Venus 0°4 S. of Jupiter				5	09	Venus stationary	
	2	02	FULL MOON				5	10	LAST QUARTER	
	5	19	Moon at perigee				10	06	Venus 3° S. of Moon	
	6	08	Neptune 3° S. of Moon				10	23	Mars 5° N. of Moon	
	6	16	Pluto at opposition				13	07	NEW MOON	Eclipse
	6	20	Earth at aphelion				14	11	Moon at apogee	
	8	20	LAST QUARTER				15	06	Mercury 5° S. of Moon	
	9	03	Uranus 0°8 N. of Moon	Occn.			15	18	Ceres stationary	
	10	04	Venus greatest illuminated extent				17	13	Mercury stationary	
	12	18	<i>Aldebaran</i> 0°9 S. of Moon	Occn.			19	03	Saturn 3° S. of Moon	
	16	01	NEW MOON				21	09	FIRST QUARTER	
	18	18	Jupiter 4° N. of Moon				21	15	Venus greatest illuminated extent	
	19	01	Venus 0°4 N. of Moon	Occn.			23	08	Equinox	
	21	11	Moon at apogee				24	17	Mars 0°8 N. of <i>Regulus</i>	
	23	06	Venus stationary				24	19	Pluto stationary	
	23	19	Mercury in superior conjunction				26	10	Neptune 3° S. of Moon	
	24	04	FIRST QUARTER				27	04	Juno in conjunction with Sun	
	25	08	Ceres at opposition				28	02	Moon at perigee	
	26	08	Saturn 2° S. of Moon				28	03	FULL MOON	Eclipse
	26	16	Uranus stationary				29	01	Uranus 1°0 N. of Moon	Occn.
	31	11	FULL MOON				29	03	Vesta at opposition	
	31	20	Venus 6° S. of Jupiter				30	15	Mercury in inferior conjunction	
Aug.	2	10	Moon at perigee			Oct.	2	13	<i>Aldebaran</i> 0°5 S. of Moon	Occn.
	2	15	Neptune 3° S. of Moon				4	21	LAST QUARTER	

CONFIGURATIONS OF SUN, MOON AND PLANETS

	d	h				d	h			
Oct.	8	21	Venus 0°7' N. of Moon	Occn.	Nov.	17	16	Vesta stationary		
	8	22	Mercury stationary			18	21	Neptune stationary		
	9	17	Mars 3° N. of Moon			19	06	FIRST QUARTER		
	9	21	Venus 3° S. of <i>Regulus</i>			20	02	Neptune 3° S. of Moon		
	10	00	Jupiter 3° N. of Moon			22	19	Uranus 0°9' N. of Moon	Occn.	
	11	12	Mercury 0°9' N. of Moon	Occn.		23	20	Moon at perigee		
	11	13	Moon at apogee			25	23	FULL MOON		
	12	04	Uranus at opposition			26	10	<i>Aldebaran</i> 0°7' S. of Moon	Occn.	
	13	00	NEW MOON			28	16	Venus 4° N. of <i>Spica</i>		
	16	03	Mercury greatest elong. W. (18°)			30	00	Saturn in conjunction with Sun		
	16	13	Saturn 3° S. of Moon		Dec.	3	08	LAST QUARTER		
	17	14	Mars 0°4' N. of Jupiter			4	06	Jupiter 1°8' N. of Moon		
	20	21	FIRST QUARTER			5	15	Moon at apogee		
	23	19	Neptune 3° S. of Moon			6	03	Mars 0°1' N. of Moon	Occn.	
	26	07	Venus greatest elong. W. (46°)			7	17	Venus 0°7' S. of Moon	Occn.	
	26	08	Venus 1°1' S. of Jupiter			11	10	NEW MOON		
	26	10	Uranus 0°9' N. of Moon	Occn.		17	08	Neptune 3° S. of Moon		
	26	13	Moon at perigee			18	15	FIRST QUARTER		
	27	12	FULL MOON			20	01	Uranus 1°2' N. of Moon	Occn.	
	28	19	Mercury 4° N. of <i>Spica</i>			21	09	Moon at perigee		
	29	23	<i>Aldebaran</i> 0°6' S. of Moon	Occn.		21	12	Mars 4° N. of <i>Spica</i>		
Nov.	3	12	LAST QUARTER			22	05	Solstice		
	3	16	Venus 0°7' S. of Mars			23	20	<i>Aldebaran</i> 0°7' S. of Moon	Occn.	
	6	16	Jupiter 2° N. of Moon			25	11	FULL MOON		
	7	10	Mars 1°8' N. of Moon			26	11	Uranus stationary		
	7	14	Venus 1°2' N. of Moon			29	03	Mercury greatest elong. E. (20°)		
	7	22	Moon at apogee			31	18	Jupiter 1°5' N. of Moon		
	11	18	NEW MOON							
	13	01	Saturn 3° S. of Moon							
	17	15	Mercury in superior conjunction							

PREDICTED PERIHELION PASSAGES OF COMETS, 2015

Periodic comet	Perihelion			Periodic comet	Perihelion		
	date	distance			date	distance	
	<i>T</i>	<i>q</i> (au)	<i>P</i> (yr)		<i>T</i>	<i>q</i> (au)	<i>P</i> (yr)
201P/LONEOS	Jan. 14	1.34	6.43	19P/Borrelly	May 28	1.35	6.83
7P/Pons-Winnecke	Jan. 30	1.24	6.32	P/2009 Q4 (Boattini)	June 13	1.32	5.55
P/2005 Q4 (LINEAR)	Feb. 16	1.74	9.36	P/2010 B2 (WISE)	June 13	1.61	5.48
92P/Sanguin	Mar. 1	1.83	12.41	220P/McNaught	June 13	1.55	5.50
6P/d'Arrest	Mar. 2	1.36	6.56	148P/Anderson-LINEAR	June 13	1.69	7.04
44P/Reinmuth	Mar. 24	2.12	7.10	196P/Tichý	June 14	2.14	7.33
P/2008 WZ ₉₆ (LINEAR)	Mar. 25	1.65	6.15	P/2012 F5 (Gibbs)	June 15	2.88	5.21
86P/Wild	Apr. 3	2.26	6.84	P/2009 WX ₅₁ (Catalina)	June 25	0.80	5.39
88P/Howell	Apr. 6	1.36	5.48	233P/La Sagra	June 25	1.79	5.28
42P/Neujmin	Apr. 8	2.03	10.77	P/2008 S1	July 1	1.20	6.76
P/2006 S6 (Hill)	Apr. 18	2.38	8.47	(Catalina-McNaught)			
174P/Echeclus	Apr. 22	5.82	34.92	221P/LINEAR	July 11	1.76	6.44
218P/LINEAR	Apr. 23	1.17	5.45	162P/Siding Spring	July 11	1.23	5.34
113P/Spitaler	Apr. 23	2.12	7.06	P/2004 FY ₁₄₀ (LINEAR)	July 24	4.06	10.82
P/2005 V1 (Bernardi)	Apr. 27	2.42	9.76	140P/Bowell-Skiff	Aug. 8	1.99	16.39
P/1997 T3	May 8	4.23	17.10	P/2004 R1 (McNaught)	Aug. 12	0.98	5.46
(Lagerkvist-Carsenty)				51P/Harrington	Aug. 12	1.70	7.16
P/2007 S1 (Zhao)	May 10	2.49	7.41	67P/Churyumov-Gerasimenko	Aug. 13	1.24	6.44
205P/Giacobini	May 14	1.54	6.69	P/2010 K2 (WISE)	Aug. 13	1.27	5.10
P/2008 QP ₂₀ (LINEAR-Hill)	May 17	1.72	6.52	P/2009 L2 (Yang-Gao)	Aug. 15	1.43	6.61
57P/du Toit-Neujmin-Delporte	May 22	1.73	6.42				

continued on page 6 ...

CHRONOLOGICAL CYCLES AND ERAS

Dominical Letter	...	D	Julian Period (year of)	...	6728
Epact	...	10	Roman Indiction	...	8
Golden Number (Lunar Cycle)	...	II	Solar Cycle	...	8

All dates are given in terms of the Gregorian calendar in which
2015 January 14 corresponds to 2015 January 1 of the Julian calendar.

ERA	YEAR	BEGINS	ERA	YEAR	BEGINS
Byzantine	...	7524 Sept. 14	Japanese	...	2675 Jan. 1
Jewish (A.M.)*	...	5776 Sept. 13	Seleucidæ (Grecian)	...	2327 Sept. 14
Chinese (yǐ wēi)	...	Feb. 19			(or Oct. 14)
Roman (A.U.C.)	...	2768 Jan. 14	Saka (Indian)	...	1937 Mar. 22
Nabonassar	...	2764 Apr. 20	Diocletian (Coptic)	...	1732 Sept. 12
			Islamic (Hegira)*	...	1437 Oct. 14

* Year begins at sunset

RELIGIOUS CALENDARS

Epiphany	...	Jan. 6	Ascension Day	...	May 14
Ash Wednesday	...	Feb. 18	Whit Sunday—Pentecost	...	May 24
Palm Sunday	...	Mar. 29	Trinity Sunday	...	May 31
Good Friday	...	Apr. 3	First Sunday in Advent	...	Nov. 29
Easter Day	...	Apr. 5	Christmas Day (Friday)	...	Dec. 25
First Day of Passover (Pesach)	...	Apr. 4	Day of Atonement (Yom Kippur)	...	Sept. 23
Feast of Weeks (Shavuot)	...	May 24	First day of Tabernacles	...	
Jewish New Year‡	...		(Succoth)	...	Sept. 28
(Rosh Hashanah)	...	Sept. 14	Festival of Lights (Hanukkah)	...	Dec. 7
First day of Ramadân‡	...	June 18	Islamic New Year‡	...	Oct. 15
First day of Shawwal‡	...	July 18			

‡The Jewish and Islamic dates above are tabular dates, which begin at sunset on the previous evening and end at sunset on the date tabulated. In practice, the dates of Islamic fasts and festivals are determined by an actual sighting of the appropriate new Moon.

CIVIL CALENDAR—UNITED STATES OF AMERICA

New Year's Day	...	Jan. 1	Labor Day	...	Sept. 7
Martin Luther King's Birthday	...	Jan. 19	Columbus Day	...	Oct. 12
Washington's Birthday	...	Feb. 16	Election Day (in certain States)	...	Nov. 3
Memorial Day	...	May 25	Veterans Day	...	Nov. 11
Independence Day	...	July 4	Thanksgiving Day	...	Nov. 26

CIVIL CALENDAR—UNITED KINGDOM

Accession of Queen Elizabeth II	...	Feb. 6	Birthday of Prince Philip,	...	
St David (Wales)	...	Mar. 1	Duke of Edinburgh	...	June 10
Commonwealth Day	...	Mar. 9	The Queen's Official Birthday†	...	June 13
St Patrick (Ireland)	...	Mar. 17	Remembrance Sunday	...	Nov. 8
Birthday of Queen Elizabeth II	...	Apr. 21	Birthday of the Prince of Wales	...	Nov. 14
St George (England)	...	Apr. 23	St Andrew (Scotland)	...	Nov. 30
Coronation Day	...	June 2			

†Date subject to confirmation

	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE	
Day of Month	Day of Week	Day of Year	Day of Week	Day of Year	Day of Week	Day of Year	Day of Week	Day of Year	Day of Week	Day of Year	Day of Week	Day of Year
1	Thu.	1	Sun.	32	Sun.	60	Wed.	91	Fri.	121	Mon.	152
2	Fri.	2	Mon.	33	Mon.	61	Thu.	92	Sat.	122	Tue.	153
3	Sat.	3	Tue.	34	Tue.	62	Fri.	93	Sun.	123	Wed.	154
4	Sun.	4	Wed.	35	Wed.	63	Sat.	94	Mon.	124	Thu.	155
5	Mon.	5	Thu.	36	Thu.	64	Sun.	95	Tue.	125	Fri.	156
6	Tue.	6	Fri.	37	Fri.	65	Mon.	96	Wed.	126	Sat.	157
7	Wed.	7	Sat.	38	Sat.	66	Tue.	97	Thu.	127	Sun.	158
8	Thu.	8	Sun.	39	Sun.	67	Wed.	98	Fri.	128	Mon.	159
9	Fri.	9	Mon.	40	Mon.	68	Thu.	99	Sat.	129	Tue.	160
10	Sat.	10	Tue.	41	Tue.	69	Fri.	100	Sun.	130	Wed.	161
11	Sun.	11	Wed.	42	Wed.	70	Sat.	101	Mon.	131	Thu.	162
12	Mon.	12	Thu.	43	Thu.	71	Sun.	102	Tue.	132	Fri.	163
13	Tue.	13	Fri.	44	Fri.	72	Mon.	103	Wed.	133	Sat.	164
14	Wed.	14	Sat.	45	Sat.	73	Tue.	104	Thu.	134	Sun.	165
15	Thu.	15	Sun.	46	Sun.	74	Wed.	105	Fri.	135	Mon.	166
16	Fri.	16	Mon.	47	Mon.	75	Thu.	106	Sat.	136	Tue.	167
17	Sat.	17	Tue.	48	Tue.	76	Fri.	107	Sun.	137	Wed.	168
18	Sun.	18	Wed.	49	Wed.	77	Sat.	108	Mon.	138	Thu.	169
19	Mon.	19	Thu.	50	Thu.	78	Sun.	109	Tue.	139	Fri.	170
20	Tue.	20	Fri.	51	Fri.	79	Mon.	110	Wed.	140	Sat.	171
21	Wed.	21	Sat.	52	Sat.	80	Tue.	111	Thu.	141	Sun.	172
22	Thu.	22	Sun.	53	Sun.	81	Wed.	112	Fri.	142	Mon.	173
23	Fri.	23	Mon.	54	Mon.	82	Thu.	113	Sat.	143	Tue.	174
24	Sat.	24	Tue.	55	Tue.	83	Fri.	114	Sun.	144	Wed.	175
25	Sun.	25	Wed.	56	Wed.	84	Sat.	115	Mon.	145	Thu.	176
26	Mon.	26	Thu.	57	Thu.	85	Sun.	116	Tue.	146	Fri.	177
27	Tue.	27	Fri.	58	Fri.	86	Mon.	117	Wed.	147	Sat.	178
28	Wed.	28	Sat.	59	Sat.	87	Tue.	118	Thu.	148	Sun.	179
29	Thu.	29			Sun.	88	Wed.	119	Fri.	149	Mon.	180
30	Fri.	30			Mon.	89	Thu.	120	Sat.	150	Tue.	181
31	Sat.	31			Tue.	90			Sun.	151		

JULIAN DATE, 2015

0 ^h UT	JD	0 ^h UT	JD	0 ^h UT	JD
Jan. 0	245 7022.5	May 0	245 7142.5	Sept. 0	245 7265.5
Feb. 0	245 7053.5	June 0	245 7173.5	Oct. 0	245 7295.5
Mar. 0	245 7081.5	July 0	245 7203.5	Nov. 0	245 7326.5
Apr. 0	245 7112.5	Aug. 0	245 7234.5	Dec. 0	245 7356.5

400-day date, JD 245 7200.5 = 2015 June 27.0

Standard epoch, 1900 January 0, 12^h UT = JD 241 5020.0
Standard epoch, B1950.0 = 1950 Jan. 0.923 = JD 243 3282.423
B2015.0 = 2015 Jan. 0.666 = JD 245 7023.166
Standard epoch, J2000.0 = 2000 Jan. 1.5 = JD 245 1545.0
J2015.5 = 2015 July 2.875 = JD 245 7206.375

JULY			AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
Day of Month	Day of Week	Day of Year	Day of Week	Day of Year	Day of Week	Day of Year	Day of Week	Day of Year	Day of Week	Day of Year	Day of Week	Day of Year
1	Wed.	182	Sat.	213	Tue.	244	Thu.	274	Sun.	305	Tue.	335
2	Thu.	183	Sun.	214	Wed.	245	Fri.	275	Mon.	306	Wed.	336
3	Fri.	184	Mon.	215	Thu.	246	Sat.	276	Tue.	307	Thu.	337
4	Sat.	185	Tue.	216	Fri.	247	Sun.	277	Wed.	308	Fri.	338
5	Sun.	186	Wed.	217	Sat.	248	Mon.	278	Thu.	309	Sat.	339
6	Mon.	187	Thu.	218	Sun.	249	Tue.	279	Fri.	310	Sun.	340
7	Tue.	188	Fri.	219	Mon.	250	Wed.	280	Sat.	311	Mon.	341
8	Wed.	189	Sat.	220	Tue.	251	Thu.	281	Sun.	312	Tue.	342
9	Thu.	190	Sun.	221	Wed.	252	Fri.	282	Mon.	313	Wed.	343
10	Fri.	191	Mon.	222	Thu.	253	Sat.	283	Tue.	314	Thu.	344
11	Sat.	192	Tue.	223	Fri.	254	Sun.	284	Wed.	315	Fri.	345
12	Sun.	193	Wed.	224	Sat.	255	Mon.	285	Thu.	316	Sat.	346
13	Mon.	194	Thu.	225	Sun.	256	Tue.	286	Fri.	317	Sun.	347
14	Tue.	195	Fri.	226	Mon.	257	Wed.	287	Sat.	318	Mon.	348
15	Wed.	196	Sat.	227	Tue.	258	Thu.	288	Sun.	319	Tue.	349
16	Thu.	197	Sun.	228	Wed.	259	Fri.	289	Mon.	320	Wed.	350
17	Fri.	198	Mon.	229	Thu.	260	Sat.	290	Tue.	321	Thu.	351
18	Sat.	199	Tue.	230	Fri.	261	Sun.	291	Wed.	322	Fri.	352
19	Sun.	200	Wed.	231	Sat.	262	Mon.	292	Thu.	323	Sat.	353
20	Mon.	201	Thu.	232	Sun.	263	Tue.	293	Fri.	324	Sun.	354
21	Tue.	202	Fri.	233	Mon.	264	Wed.	294	Sat.	325	Mon.	355
22	Wed.	203	Sat.	234	Tue.	265	Thu.	295	Sun.	326	Tue.	356
23	Thu.	204	Sun.	235	Wed.	266	Fri.	296	Mon.	327	Wed.	357
24	Fri.	205	Mon.	236	Thu.	267	Sat.	297	Tue.	328	Thu.	358
25	Sat.	206	Tue.	237	Fri.	268	Sun.	298	Wed.	329	Fri.	359
26	Sun.	207	Wed.	238	Sat.	269	Mon.	299	Thu.	330	Sat.	360
27	Mon.	208	Thu.	239	Sun.	270	Tue.	300	Fri.	331	Sun.	361
28	Tue.	209	Fri.	240	Mon.	271	Wed.	301	Sat.	332	Mon.	362
29	Wed.	210	Sat.	241	Tue.	272	Thu.	302	Sun.	333	Tue.	363
30	Thu.	211	Sun.	242	Wed.	273	Fri.	303	Mon.	334	Wed.	364
31	Fri.	212	Mon.	243			Sat.	304			Thu.	365

MEAN SIDEREAL TIME, 2015

Greenwich mean sidereal time at 0^h UT

Jan. 0	^h 6-6229	Apr. 0	^h 12-5368	July 0	^h 18-5164	Oct. 0	^h 0-5617
Feb. 0	8-6599	May 0	14-5081	Aug. 0	20-5534	Nov. 0	2-5987
Mar. 0	10-4998	June 0	16-5451	Sept. 0	22-5904	Dec. 0	4-5700

Greenwich mean sidereal time (GMST) on day d of month at hour t UT

$$= \text{GMST at } 0^{\text{h}} \text{ UT on day } 0 + 0^{\text{h}}065\,71\,d + 1^{\text{h}}002\,74\,t$$

$$\text{Local mean sidereal time} = \text{GMST} \begin{matrix} + \text{east} \\ - \text{west} \end{matrix} \text{ longitude}$$

AT 0^h UNIVERSAL TIME

	Equation Date	Declin- ation		Equation Date	Declin- ation		Equation Date	Declin- ation		Equation Date	Declin- ation				
	^m ^s	[°] [']		^m ^s	[°] [']		^m ^s	[°] [']		^m ^s	[°] [']				
Jan.	0	-02 43	-23 07	Feb.	15	-14 07	-12 52	Apr.	1	-04 06	+04 20	May	17	+03 38	+19 12
	1	03 11	23 02		16	14 05	12 31		2	03 48	04 43		18	03 37	19 26
	2	03 40	22 58		17	14 01	12 10		3	03 30	05 06		19	03 34	19 39
	3	04 07	22 52		18	13 57	11 49		4	03 13	05 29		20	03 31	19 52
	4	04 35	22 46		19	13 52	11 28		5	02 55	05 52		21	03 28	20 04
	5	-05 02	-22 40		20	-13 47	-11 07		6	-02 38	+06 15		22	+03 24	+20 16
	6	05 29	22 33		21	13 41	10 45		7	02 21	06 37		23	03 19	20 28
	7	05 55	22 26		22	13 34	10 23		8	02 04	07 00		24	03 14	20 40
	8	06 21	22 18		23	13 26	10 02		9	01 47	07 22		25	03 09	20 51
	9	06 46	22 10		24	13 18	09 40		10	01 31	07 45		26	03 03	21 02
	10	-07 11	-22 02		25	-13 09	-09 17		11	-01 15	+08 07		27	+02 56	+21 12
	11	07 35	21 53		26	13 00	08 55		12	00 59	08 29		28	02 50	21 22
	12	07 59	21 44		27	12 50	08 33		13	00 43	08 51		29	02 42	21 32
	13	08 22	21 34		28	12 39	08 10		14	00 28	09 13		30	02 34	21 41
14	08 45	21 24	Mar.	1	12 28	07 47	15	-00 13	09 34	31	02 26	21 50			
15	-09 07	-21 13		2	-12 17	-07 25	16	+00 01	+09 56	June	1	+02 18	+21 59		
16	09 28	21 02		3	12 05	07 02	17	00 15	10 17		2	02 09	22 07		
17	09 48	20 51		4	11 52	06 39	18	00 29	10 38		3	01 59	22 15		
18	10 08	20 39		5	11 39	06 16	19	00 43	10 59		4	01 49	22 22		
19	10 28	20 27		6	11 25	05 52	20	00 56	11 20		5	01 39	22 29		
20	-10 46	-20 14		7	-11 11	-05 29	21	+01 08	+11 40		6	+01 29	+22 35		
21	11 04	20 01		8	10 57	05 06	22	01 20	12 01		7	01 18	22 42		
22	11 21	19 48		9	10 42	04 43	23	01 32	12 21		8	01 07	22 47		
23	11 37	19 34		10	10 27	04 19	24	01 43	12 41		9	00 55	22 53		
24	11 53	19 20		11	10 12	03 56	25	01 54	13 01		10	00 44	22 58		
25	-12 07	-19 05		12	-09 56	-03 32	26	+02 04	+13 20		11	+00 32	+23 02		
26	12 21	18 51		13	09 40	03 08	27	02 14	13 40		12	00 19	23 07		
27	12 34	18 36		14	09 24	02 45	28	02 23	13 59		13	+00 07	23 10		
28	12 46	18 20	15	09 07	02 21	29	02 32	14 18	14		-00 06	23 14			
29	12 58	18 04	16	08 51	01 57	30	02 41	14 36	15	00 18	23 17				
Feb.	30	-13 08	-17 48	17	-08 34	-01 34	May	1	+02 49	+14 55	16	-00 31	+23 19		
	31	13 18	17 32	18	08 17	01 10		2	02 56	15 13	17	00 44	23 22		
	1	13 27	17 15	19	07 59	00 46		3	03 03	15 31	18	00 57	23 23		
	2	13 35	16 58	20	07 42	-00 22		4	03 09	15 48	19	01 10	23 25		
	3	13 42	16 41	21	07 24	+00 01		5	03 15	16 06	20	01 24	23 25		
	4	-13 49	-16 23	22	-07 06	+00 25		6	+03 20	+16 23	21	-01 37	+23 26		
	5	13 54	16 05	23	06 49	00 49		7	03 25	16 40	22	01 50	23 26		
	6	13 59	15 47	24	06 31	01 12		8	03 29	16 56	23	02 03	23 26		
	7	14 03	15 28	25	06 13	01 36		9	03 32	17 13	24	02 16	23 25		
	8	14 06	15 10	26	05 55	02 00		10	03 35	17 29	25	02 29	23 24		
	9	-14 09	-14 51	27	-05 36	+02 23		11	+03 37	+17 44	26	-02 42	+23 22		
	10	14 10	14 31	28	05 18	02 47		12	03 39	18 00	27	02 54	23 20		
	11	14 11	14 12	29	05 00	03 10		13	03 40	18 15	28	03 07	23 18		
	12	14 11	13 52	30	04 42	03 33		14	03 40	18 30	29	03 19	23 15		
13	14 11	13 32	31	04 24	03 57	15	03 40	18 44	30	03 31	23 12				
	14	-14 10	-13 12	Apr.	1	-04 06	+04 20	16	+03 40	+18 58	July	1	-03 43	+23 08	
	15	-14 07	-12 52		2	-03 48	+04 43	17	+03 38	+19 12		2	-03 54	+23 04	

Equation of time = apparent time - mean time

AT 0^h UNIVERSAL TIME

	Equation Date	Declin- of time	ation		Equation Date	Declin- of time	ation		Equation Date	Declin- of time	ation		Equation Date	Declin- of time	ation
July	1	^m −03 43	^s +23 08	Aug. 16	17	^m −04 26	^s +13 54	Oct. 1	2	^m +10 05	^s −02 59	Nov. 16	17	^m +15 22	^s −18 36
	2	03 54	23 04		17	04 14	13 35		2	10 25	03 22		17	15 11	18 51
	3	04 05	23 00		18	04 01	13 16		3	10 44	03 45		18	14 59	19 05
	4	04 16	22 55		19	03 48	12 57		4	11 03	04 08		19	14 47	19 20
	5	04 27	22 50		20	03 34	12 37		5	11 21	04 31		20	14 34	19 34
	6	−04 37	+22 44		21	−03 20	+12 17		6	+11 39	−04 54		21	+14 20	−19 47
	7	04 47	22 38		22	03 05	11 57		7	11 57	05 17		22	14 05	20 00
	8	04 57	22 32		23	02 50	11 37		8	12 14	05 40		23	13 49	20 13
	9	05 06	22 25		24	02 35	11 17		9	12 31	06 03		24	13 33	20 26
	10	05 15	22 18		25	02 19	10 56		10	12 48	06 26		25	13 15	20 38
	11	−05 24	+22 10		26	−02 02	+10 36		11	+13 04	−06 49		26	+12 58	−20 50
	12	05 32	22 02		27	01 45	10 15		12	13 19	07 11		27	12 39	21 01
	13	05 40	21 54		28	01 28	09 54		13	13 34	07 34		28	12 19	21 12
	14	05 47	21 45		29	01 10	09 33		14	13 48	07 56		29	11 59	21 23
	15	05 53	21 36		30	00 52	09 11		15	14 02	08 19		30	11 38	21 33
	16	−06 00	+21 27		31	−00 33	+08 50		16	+14 16	−08 41	Dec. 1	1	+11 17	−21 43
	17	06 05	21 17	Sept. 1	1	−00 15	08 28		17	14 29	09 03		2	10 55	21 52
	18	06 11	21 07		2	+00 04	08 07		18	14 41	09 25		3	10 32	22 01
	19	06 15	20 56		3	00 24	07 45		19	14 52	09 47		4	10 08	22 09
	20	06 19	20 45		4	00 43	07 23		20	15 04	10 08		5	09 44	22 17
	21	−06 23	+20 34		5	+01 03	+07 01		21	+15 14	−10 30		6	+09 19	−22 25
	22	06 26	20 22		6	01 23	06 38		22	15 24	10 51		7	08 54	22 32
	23	06 28	20 11		7	01 43	06 16		23	15 33	11 13		8	08 28	22 39
	24	06 30	19 58		8	02 04	05 54		24	15 42	11 34		9	08 02	22 45
	25	06 31	19 46		9	02 24	05 31		25	15 49	11 54		10	07 35	22 51
	26	−06 32	+19 33		10	+02 45	+05 08		26	+15 56	−12 15		11	+07 08	−22 57
	27	06 32	19 20		11	03 06	04 46		27	16 03	12 36		12	06 40	23 02
	28	06 31	19 06		12	03 27	04 23		28	16 09	12 56		13	06 12	23 06
	29	06 30	18 52		13	03 48	04 00		29	16 14	13 16		14	05 44	23 10
	30	06 28	18 38		14	04 09	03 37		30	16 18	13 36		15	05 15	23 14
	31	−06 26	+18 23		15	+04 31	+03 14		31	+16 21	−13 56		16	+04 46	−23 17
Aug. 1	1	06 23	18 09		16	04 52	02 51	Nov. 1	1	16 24	14 15		17	04 17	23 20
	2	06 19	17 54		17	05 13	02 28		2	16 25	14 34		18	03 48	23 22
	3	06 15	17 38		18	05 35	02 05		3	16 26	14 53		19	03 18	23 24
	4	06 10	17 23		19	05 56	01 41		4	16 27	15 12		20	02 49	23 25
	5	−06 04	+17 07		20	+06 17	+01 18		5	+16 26	−15 30		21	+02 19	−23 26
	6	05 58	16 50		21	06 39	00 55		6	16 24	15 49		22	01 49	23 26
	7	05 51	16 34		22	07 00	00 31		7	16 22	16 07		23	01 20	23 26
	8	05 44	16 17		23	07 21	+00 08		8	16 19	16 24		24	00 50	23 25
	9	05 36	16 00		24	07 42	−00 15		9	16 15	16 42		25	+00 20	23 24
	10	−05 28	+15 43		25	+08 03	−00 39		10	+16 10	−16 59		26	−00 09	−23 23
	11	05 19	15 25		26	08 24	01 02		11	16 04	17 16		27	00 39	23 21
	12	05 10	15 08		27	08 45	01 25		12	15 57	17 32		28	01 08	23 18
	13	05 00	14 50		28	09 05	01 49		13	15 50	17 49		29	01 38	23 15
	14	04 49	14 31		29	09 26	02 12		14	15 41	18 05		30	02 07	23 12
	15	−04 38	+14 13		30	+09 46	−02 35		15	+15 32	−18 20		31	−02 36	−23 08
	16	−04 26	+13 54	Oct. 1	1	+10 05	−02 59		16	+15 22	−18 36		32	−03 04	−23 04

UT of transit = $12^{\text{h}} - \frac{\text{east}}{+ \text{west}}$ longitude - equation of time

AT 0^h UNIVERSAL TIME

Date	<i>Polaris</i> GHA	σ Oct GHA	Date	<i>Polaris</i> GHA	σ Oct GHA	Date	<i>Polaris</i> GHA	σ Oct GHA	Date	<i>Polaris</i> GHA	σ Oct GHA
Jan. 0	56 19	139 20	Feb. 15	101 59	184 42	Apr. 1	146 37	228 55	May 17	191 59	274 03
1	57 18	140 19	16	102 59	185 41	2	147 36	229 54	18	192 58	275 01
2	58 18	141 18	17	103 58	186 40	3	148 36	230 53	19	193 57	276 00
3	59 17	142 18	18	104 58	187 39	4	149 35	231 52	20	194 56	276 59
4	60 17	143 17	19	105 57	188 38	5	150 34	232 51	21	195 54	277 58
5	61 16	144 16	20	106 57	189 37	6	151 34	233 50	22	196 53	278 57
6	62 16	145 15	21	107 57	190 36	7	152 33	234 48	23	197 52	279 56
7	63 15	146 15	22	108 56	191 35	8	153 32	235 47	24	198 51	280 54
8	64 15	147 14	23	109 56	192 34	9	154 32	236 46	25	199 50	281 53
9	65 14	148 13	24	110 55	193 33	10	155 31	237 45	26	200 49	282 52
10	66 14	149 12	25	111 55	194 32	11	156 30	238 44	27	201 48	283 51
11	67 14	150 11	26	112 55	195 31	12	157 29	239 43	28	202 47	284 50
12	68 13	151 11	27	113 54	196 30	13	158 29	240 42	29	203 46	285 49
13	69 13	152 10	28	114 54	197 29	14	159 28	241 41	30	204 45	286 48
14	70 12	153 09	Mar. 1	115 53	198 28	15	160 27	242 39	31	205 44	287 46
15	71 12	154 08	2	116 53	199 27	16	161 27	243 38	June 1	206 43	288 45
16	72 11	155 08	3	117 52	200 26	17	162 26	244 37	2	207 41	289 44
17	73 11	156 07	4	118 52	201 25	18	163 25	245 36	3	208 40	290 43
18	74 10	157 06	5	119 51	202 24	19	164 24	246 35	4	209 39	291 42
19	75 10	158 05	6	120 51	203 23	20	165 23	247 34	5	210 38	292 41
20	76 09	159 04	7	121 51	204 22	21	166 23	248 33	6	211 37	293 40
21	77 09	160 04	8	122 50	205 21	22	167 22	249 31	7	212 36	294 38
22	78 09	161 03	9	123 50	206 20	23	168 21	250 30	8	213 34	295 37
23	79 08	162 02	10	124 49	207 19	24	169 20	251 29	9	214 33	296 36
24	80 08	163 01	11	125 49	208 18	25	170 19	252 28	10	215 32	297 35
25	81 08	164 00	12	126 48	209 17	26	171 18	253 27	11	216 31	298 34
26	82 07	164 59	13	127 48	210 16	27	172 17	254 26	12	217 30	299 33
27	83 07	165 59	14	128 47	211 15	28	173 17	255 24	13	218 29	300 32
28	84 06	166 58	15	129 47	212 14	29	174 16	256 23	14	219 27	301 31
29	85 06	167 57	16	130 46	213 12	30	175 15	257 22	15	220 26	302 29
30	86 05	168 56	17	131 46	214 11	May 1	176 14	258 21	16	221 25	303 28
31	87 05	169 55	18	132 45	215 10	2	177 13	259 20	17	222 23	304 27
Feb. 1	88 05	170 54	19	133 45	216 09	3	178 12	260 19	18	223 22	305 26
2	89 04	171 53	20	134 44	217 08	4	179 11	261 18	19	224 21	306 25
3	90 04	172 52	21	135 44	218 07	5	180 10	262 17	20	225 20	307 24
4	91 03	173 52	22	136 43	219 06	6	181 09	263 15	21	226 19	308 23
5	92 03	174 51	23	137 42	220 05	7	182 09	264 14	22	227 17	309 21
6	93 03	175 50	24	138 42	221 04	8	183 08	265 13	23	228 16	310 20
7	94 02	176 49	25	139 41	222 03	9	184 07	266 12	24	229 15	311 19
8	95 02	177 48	26	140 41	223 02	10	185 06	267 11	25	230 14	312 18
9	96 02	178 47	27	141 40	224 01	11	186 05	268 09	26	231 12	313 17
10	97 01	179 46	28	142 39	225 00	12	187 04	269 08	27	232 11	314 16
11	98 01	180 45	29	143 39	225 58	13	188 03	270 07	28	233 10	315 15
12	99 00	181 44	30	144 38	226 57	14	189 02	271 06	29	234 09	316 14
13	100 00	182 44	31	145 37	227 56	15	190 01	272 05	30	235 07	317 13
14	100 59	183 43	Apr. 1	146 37	228 55	16	191 00	273 04	July 1	236 06	318 12
15	101 59	184 42	2	147 36	229 54	17	191 59	274 03	2	237 05	319 11

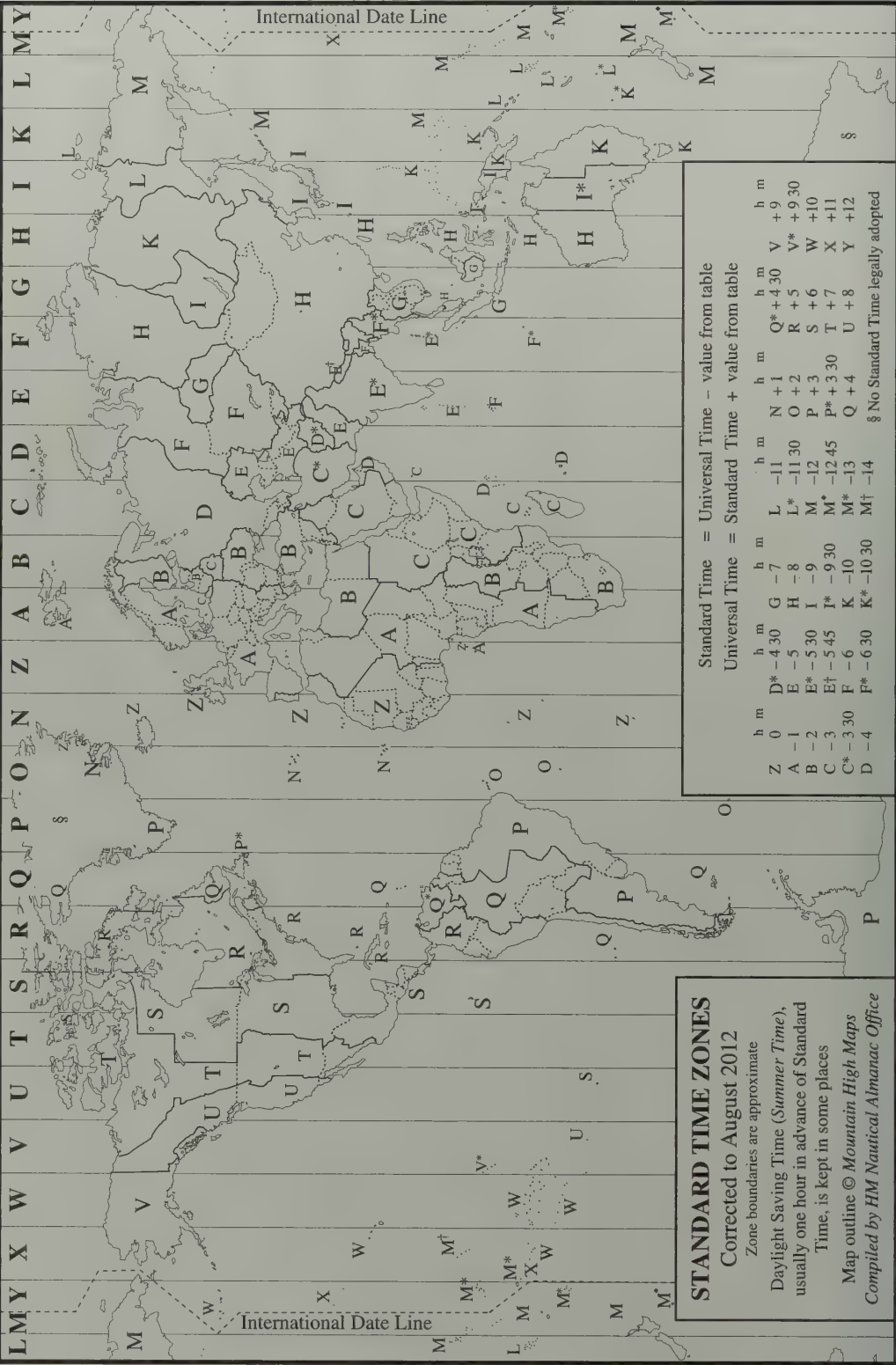
The dates between Jan. 0 and Dec. 32 below are the dates when *p* changes to the next value.

Polar Distance (<i>p</i>)	<i>Polaris</i> :	Jan. 0	40'	June 3	41'	Sept. 14	40'	Dec. 32
	σ Octantis:	Jan. 0	66'	Feb. 8	67'	Sept. 14	66'	Dec. 31 67' Dec. 32

AT 0^h UNIVERSAL TIME

Date	<i>Polaris</i> GHA	σ Oct GHA	Date	<i>Polaris</i> GHA	σ Oct GHA	Date	<i>Polaris</i> GHA	σ Oct GHA	Date	<i>Polaris</i> GHA	σ Oct GHA
July	1 236 06	318 12	Aug. 16	281 04	3 26	Oct. 1	326 05	48 51	Nov. 16	11 17	94 24
2	237 05	319 11	17	282 03	4 26	2	327 04	49 51	17	12 16	95 23
3	238 03	320 10	18	283 02	5 25	3	328 03	50 50	18	13 15	96 22
4	239 02	321 08	19	284 00	6 24	4	329 02	51 50	19	14 15	97 22
5	240 01	322 07	20	284 59	7 23	5	330 00	52 49	20	15 14	98 21
6	240 59	323 06	21	285 58	8 22	6	330 59	53 48	21	16 13	99 21
7	241 58	324 05	22	286 56	9 21	7	331 58	54 48	22	17 12	100 20
8	242 57	325 04	23	287 55	10 21	8	332 57	55 47	23	18 11	101 20
9	243 56	326 03	24	288 54	11 20	9	333 56	56 46	24	19 11	102 19
10	244 54	327 02	25	289 52	12 19	10	334 55	57 46	25	20 10	103 18
11	245 53	328 01	26	290 51	13 18	11	335 54	58 45	26	21 09	104 18
12	246 52	329 00	27	291 50	14 17	12	336 53	59 44	27	22 08	105 17
13	247 50	329 59	28	292 48	15 16	13	337 51	60 44	28	23 07	106 17
14	248 49	330 58	29	293 47	16 15	14	338 50	61 43	29	24 06	107 16
15	249 47	331 57	30	294 46	17 15	15	339 49	62 43	30	25 06	108 15
16	250 46	332 56	31	295 44	18 14	16	340 48	63 42	Dec. 1	26 05	109 15
17	251 45	333 55	Sept. 1	296 43	19 13	17	341 47	64 41	2	27 04	110 14
18	252 43	334 54	2	297 42	20 12	18	342 46	65 41	3	28 03	111 13
19	253 42	335 53	3	298 41	21 12	19	343 45	66 40	4	29 03	112 13
20	254 41	336 52	4	299 39	22 11	20	344 44	67 40	5	30 02	113 12
21	255 40	337 51	5	300 38	23 10	21	345 42	68 39	6	31 01	114 12
22	256 38	338 50	6	301 36	24 09	22	346 41	69 38	7	32 01	115 11
23	257 37	339 49	7	302 35	25 08	23	347 40	70 38	8	33 00	116 10
24	258 36	340 48	8	303 34	26 08	24	348 39	71 37	9	33 59	117 10
25	259 34	341 47	9	304 33	27 07	25	349 38	72 36	10	34 59	118 09
26	260 33	342 46	10	305 31	28 06	26	350 37	73 36	11	35 58	119 09
27	261 31	343 45	11	306 30	29 05	27	351 36	74 35	12	36 57	120 08
28	262 30	344 44	12	307 29	30 05	28	352 35	75 35	13	37 56	121 07
29	263 29	345 43	13	308 28	31 04	29	353 34	76 34	14	38 56	122 07
30	264 27	346 42	14	309 26	32 03	30	354 33	77 34	15	39 55	123 06
31	265 26	347 41	15	310 25	33 02	31	355 32	78 33	16	40 55	124 05
Aug. 1	266 25	348 40	16	311 24	34 02	Nov. 1	356 31	79 32	17	41 54	125 05
2	267 23	349 39	17	312 23	35 01	2	357 30	80 32	18	42 53	126 04
3	268 22	350 38	18	313 21	36 00	3	358 29	81 31	19	43 53	127 03
4	269 21	351 37	19	314 20	37 00	4	359 28	82 31	20	44 52	128 03
5	270 19	352 36	20	315 19	37 59	5	0 27	83 30	21	45 52	129 02
6	271 18	353 35	21	316 17	38 58	6	1 26	84 29	22	46 51	130 01
7	272 17	354 35	22	317 16	39 58	7	2 25	85 29	23	47 50	131 01
8	273 15	355 34	23	318 15	40 57	8	3 24	86 28	24	48 50	132 00
9	274 14	356 33	24	319 14	41 56	9	4 24	87 28	25	49 49	132 59
10	275 12	357 32	25	320 12	42 55	10	5 23	88 27	26	50 49	133 59
11	276 11	358 31	26	321 11	43 55	11	6 22	89 27	27	51 48	134 58
12	277 10	359 30	27	322 10	44 54	12	7 21	90 26	28	52 48	135 57
13	278 08	0 29	28	323 09	45 53	13	8 20	91 25	29	53 47	136 56
14	279 07	1 28	29	324 08	46 53	14	9 19	92 25	30	54 47	137 56
15	280 06	2 27	30	325 07	47 52	15	10 18	93 24	31	55 46	138 55
16	281 04	3 26	Oct. 1	326 05	48 51	16	11 17	94 24	32	56 46	139 54

Form the quantities $C = p \cos(\text{local hour angle})$ and $S = p \sin(\text{local hour angle})$ then
Latitude $= h_0 - C + 0.0087 S^2 \tan h_0$,
Azimuth of *Polaris* $= -S / \cos h_0$ and Azimuth of σ Octantis $= 180^\circ + S / \cos h_0$, where p and h_0
are in degrees and h_0 is the observed altitude corrected for atmospheric refraction and instrument error.



STANDARD TIME ZONES
Corrected to August 2012
Zone boundaries are approximate
Daylight Saving Time (Summer Time), usually one hour in advance of Standard Time, is kept in some places
Map outline © Mountain High Maps
Compiled by HM Nautical Almanac Office

The times of sunrise and sunset (pages 24–31) and of moonrise and moonset (pages 32–63) are the instants when the upper limbs of the Sun and Moon appear to lie on the horizon for an observer at sea-level. In both cases a fixed allowance of 34' has been made for refraction; a further allowance of 16' has been made for the semidiameter of the Sun, while for the Moon the actual value of semidiameter *minus* horizontal parallax has been used. No allowance has been made for the phase of the Moon. The observed times may differ from the tabular times because of variations in refraction and the relative heights of the observer and horizon.

The tabular values are for the universal time (UT) of the phenomena on the Greenwich meridian (longitude 0°). To a first approximation the UT at another longitude is given by subtracting the longitude, expressed in time-measure, if east of Greenwich, or by adding, if west of Greenwich. Alternatively the tables may be regarded as giving the approximate local mean time on all meridians. These times may be converted to standard time by applying the appropriate differences, as indicated in the note on page 4. Linear interpolation may be used to obtain the times for non-tabular latitudes.

In the case of the Sun it may be necessary to interpolate (mentally) to obtain the UT for an intermediate date, but a further interpolation for longitude is not normally required. In the case of the Moon the values must normally be interpolated for longitude, as well as for latitude, since the changes in the tabular values from one day to the next are usually large. The interpolating factor is equal to one twenty-fourth of the longitude if expressed in hours and decimals of an hour; linear interpolation is usually adequate.

Example

To find the times of sunrise and sunset and of moonrise and moonset on 2015 February 4 at latitude N 38° 55', longitude W 77° 15'. The longitude expressed in time-measure is W 05^h 09^m. The difference between standard time and UT is –5^h in this case.

The relevant tabular values in UT for longitude 0° are as follows:

Sunrise						Sunset						Moonrise						Moonset							
+35°						+40°						+35°						+40°							
d		h		m		h		m		d		h		m		h		m		d		h		m	
Feb. 3	06	58	07	07	17	30	17	21	Feb. 4	18	15	18	10	06	55	07	01								
	7	06	54	07	03	17	34	17		26	5	19	09	19	05	07	29	07	33						

Interpolating factor for latitude is 3° 55' / 5° = 0.78

for date for Sun is 1^d/4^d = 0.25

for long. for Moon is 5^h 15/24^h = 0.21

	Sunrise		Sunset	Moonrise		Moonset
	d	h m		d	h m	
Interpolation to:						
Latitude N 38° 55'	Feb. 3	07 05	17 23	Feb. 4	18 11	07 00
N 38° 55'	7	07 01	17 28	5	19 06	07 32
Local mean time	4	07 04	17 24	4	18 23	07 07
Adjustment to:						
Universal time	4	12 13	22 33	4	23 32	12 16
Standard time	4	07 13	17 33	4	18 32	07 16

SUNRISE AND SUNSET, 2015
UNIVERSAL TIME FOR MERIDIAN OF GREENWICH
SUNRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan. −2	3 22	3 52	4 14	4 32	4 47	5 00	5 22	5 41	5 58	6 16	6 34	6 55	7 07	7 21
2	3 27	3 56	4 18	4 35	4 50	5 03	5 24	5 43	6 00	6 17	6 35	6 56	7 08	7 22
6	3 32	4 00	4 22	4 39	4 53	5 06	5 27	5 45	6 02	6 19	6 36	6 57	7 09	7 22
10	3 38	4 06	4 26	4 43	4 57	5 09	5 30	5 47	6 04	6 20	6 37	6 57	7 08	7 22
14	3 45	4 11	4 31	4 47	5 01	5 12	5 32	5 49	6 05	6 21	6 38	6 57	7 08	7 20
18	3 53	4 17	4 36	4 52	5 05	5 16	5 35	5 51	6 07	6 22	6 38	6 56	7 07	7 19
22	4 01	4 24	4 42	4 56	5 09	5 19	5 38	5 53	6 08	6 22	6 38	6 55	7 05	7 17
26	4 09	4 31	4 47	5 01	5 13	5 23	5 40	5 55	6 09	6 23	6 37	6 54	7 03	7 14
30	4 17	4 38	4 53	5 06	5 17	5 26	5 43	5 57	6 10	6 23	6 36	6 52	7 01	7 11
Feb. 3	4 26	4 45	4 59	5 11	5 21	5 30	5 45	5 58	6 10	6 22	6 35	6 49	6 58	7 07
7	4 35	4 52	5 05	5 16	5 25	5 33	5 47	5 59	6 11	6 22	6 33	6 47	6 54	7 03
11	4 43	4 59	5 11	5 21	5 29	5 37	5 50	6 01	6 11	6 21	6 32	6 44	6 50	6 58
15	4 52	5 06	5 17	5 26	5 33	5 40	5 52	6 01	6 11	6 20	6 29	6 40	6 46	6 53
19	5 01	5 13	5 22	5 30	5 37	5 43	5 53	6 02	6 10	6 19	6 27	6 37	6 42	6 48
23	5 09	5 20	5 28	5 35	5 41	5 46	5 55	6 03	6 10	6 17	6 24	6 33	6 37	6 43
27	5 18	5 27	5 34	5 40	5 45	5 49	5 57	6 03	6 09	6 15	6 22	6 29	6 33	6 37
Mar. 3	5 26	5 33	5 39	5 44	5 48	5 52	5 58	6 04	6 09	6 14	6 19	6 24	6 27	6 31
7	5 34	5 40	5 45	5 49	5 52	5 55	6 00	6 04	6 08	6 12	6 15	6 20	6 22	6 25
11	5 42	5 47	5 50	5 53	5 55	5 57	6 01	6 04	6 07	6 09	6 12	6 15	6 17	6 19
15	5 50	5 53	5 55	5 57	5 59	6 00	6 02	6 04	6 06	6 07	6 09	6 10	6 11	6 12
19	5 58	6 00	6 01	6 01	6 02	6 03	6 03	6 04	6 05	6 05	6 05	6 06	6 06	6 06
23	6 06	6 06	6 06	6 05	6 05	6 05	6 05	6 04	6 03	6 03	6 02	6 01	6 00	5 59
27	6 14	6 12	6 11	6 10	6 08	6 07	6 06	6 04	6 02	6 00	5 58	5 56	5 55	5 53
31	6 22	6 18	6 16	6 14	6 12	6 10	6 07	6 04	6 01	5 58	5 55	5 51	5 49	5 46
Apr. 4	6 29	6 25	6 21	6 18	6 15	6 12	6 08	6 04	6 00	5 56	5 51	5 46	5 43	5 40

SUNSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan. −2	20 41	20 12	19 49	19 32	19 17	19 04	18 42	18 23	18 06	17 48	17 30	17 09	16 57	16 43
2	20 40	20 11	19 50	19 32	19 17	19 05	18 43	18 25	18 08	17 51	17 33	17 12	17 00	16 46
6	20 38	20 10	19 49	19 32	19 18	19 05	18 44	18 26	18 09	17 53	17 35	17 15	17 03	16 50
10	20 35	20 08	19 48	19 31	19 18	19 06	18 45	18 27	18 11	17 55	17 38	17 18	17 07	16 53
14	20 32	20 06	19 46	19 30	19 17	19 05	18 45	18 28	18 13	17 57	17 40	17 21	17 10	16 58
18	20 27	20 02	19 44	19 28	19 16	19 04	18 45	18 29	18 14	17 59	17 43	17 25	17 14	17 02
22	20 21	19 58	19 40	19 26	19 14	19 03	18 45	18 30	18 15	18 01	17 46	17 28	17 18	17 07
26	20 15	19 53	19 37	19 23	19 12	19 02	18 45	18 30	18 16	18 02	17 48	17 32	17 22	17 11
30	20 08	19 48	19 32	19 20	19 09	19 00	18 44	18 30	18 17	18 04	17 50	17 35	17 26	17 16
Feb. 3	20 00	19 42	19 28	19 16	19 06	18 57	18 42	18 29	18 17	18 05	17 53	17 39	17 30	17 21
7	19 52	19 35	19 22	19 12	19 02	18 54	18 41	18 29	18 18	18 07	17 55	17 42	17 34	17 26
11	19 44	19 29	19 17	19 07	18 58	18 51	18 39	18 28	18 18	18 08	17 57	17 45	17 38	17 31
15	19 35	19 21	19 11	19 02	18 54	18 48	18 36	18 27	18 18	18 09	17 59	17 48	17 42	17 35
19	19 26	19 14	19 04	18 57	18 50	18 44	18 34	18 25	18 17	18 09	18 01	17 51	17 46	17 40
23	19 16	19 06	18 58	18 51	18 45	18 40	18 31	18 24	18 17	18 10	18 03	17 54	17 50	17 45
27	19 06	18 58	18 51	18 45	18 40	18 36	18 28	18 22	18 16	18 10	18 04	17 57	17 53	17 49
Mar. 3	18 57	18 50	18 44	18 39	18 35	18 31	18 25	18 20	18 15	18 11	18 06	18 00	17 57	17 54
7	18 47	18 41	18 37	18 33	18 30	18 27	18 22	18 18	18 14	18 11	18 07	18 03	18 01	17 58
11	18 37	18 33	18 29	18 27	18 24	18 22	18 19	18 16	18 13	18 11	18 08	18 05	18 04	18 02
15	18 26	18 24	18 22	18 20	18 19	18 18	18 15	18 14	18 12	18 11	18 09	18 08	18 07	18 06
19	18 16	18 15	18 14	18 14	18 13	18 13	18 12	18 11	18 11	18 11	18 11	18 11	18 11	18 11
23	18 06	18 06	18 07	18 07	18 08	18 08	18 09	18 09	18 10	18 11	18 12	18 13	18 14	18 15
27	17 56	17 58	17 59	18 01	18 02	18 03	18 05	18 07	18 09	18 11	18 13	18 15	18 17	18 19
31	17 46	17 49	17 52	17 54	17 56	17 58	18 02	18 05	18 08	18 11	18 14	18 18	18 20	18 23
Apr. 4	17 36	17 41	17 45	17 48	17 51	17 53	17 58	18 02	18 06	18 10	18 15	18 20	18 23	18 27

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

SUNRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan. -2	7 21	7 28	7 34	7 42	7 50	7 58	8 08	8 19	8 32	8 46	9 03	9 24	9 52	10 32
2	7 22	7 28	7 35	7 42	7 50	7 58	8 08	8 19	8 31	8 45	9 02	9 22	9 49	10 26
6	7 22	7 28	7 35	7 42	7 49	7 58	8 07	8 17	8 29	8 43	8 59	9 19	9 43	10 18
10	7 22	7 27	7 34	7 41	7 48	7 56	8 05	8 15	8 26	8 40	8 55	9 13	9 37	10 08
14	7 20	7 26	7 32	7 39	7 46	7 54	8 02	8 12	8 23	8 35	8 50	9 07	9 28	9 57
18	7 19	7 24	7 30	7 36	7 43	7 50	7 59	8 08	8 18	8 30	8 43	8 59	9 19	9 45
22	7 17	7 22	7 27	7 33	7 40	7 47	7 54	8 03	8 12	8 23	8 36	8 51	9 09	9 32
26	7 14	7 19	7 24	7 29	7 35	7 42	7 49	7 57	8 06	8 16	8 28	8 42	8 58	9 18
30	7 11	7 15	7 20	7 25	7 31	7 37	7 44	7 51	7 59	8 09	8 19	8 32	8 46	9 04
Feb. 3	7 07	7 11	7 16	7 20	7 26	7 31	7 37	7 44	7 52	8 00	8 10	8 21	8 34	8 50
7	7 03	7 07	7 11	7 15	7 20	7 25	7 31	7 37	7 44	7 51	8 00	8 10	8 22	8 36
11	6 58	7 02	7 05	7 09	7 14	7 18	7 23	7 29	7 35	7 42	7 50	7 59	8 09	8 21
15	6 53	6 56	7 00	7 03	7 07	7 11	7 16	7 21	7 26	7 32	7 39	7 47	7 56	8 07
19	6 48	6 51	6 54	6 57	7 00	7 04	7 08	7 12	7 17	7 22	7 28	7 35	7 43	7 52
23	6 43	6 45	6 48	6 50	6 53	6 56	7 00	7 03	7 07	7 12	7 17	7 23	7 29	7 37
27	6 37	6 39	6 41	6 43	6 46	6 48	6 51	6 54	6 57	7 01	7 05	7 10	7 16	7 22
Mar. 3	6 31	6 33	6 34	6 36	6 38	6 40	6 42	6 45	6 47	6 50	6 54	6 57	7 02	7 07
7	6 25	6 26	6 27	6 29	6 30	6 32	6 33	6 35	6 37	6 39	6 42	6 45	6 48	6 52
11	6 19	6 19	6 20	6 21	6 22	6 23	6 24	6 26	6 27	6 28	6 30	6 32	6 34	6 36
15	6 12	6 13	6 13	6 14	6 14	6 15	6 15	6 16	6 16	6 17	6 18	6 19	6 20	6 21
19	6 06	6 06	6 06	6 06	6 06	6 06	6 06	6 06	6 06	6 06	6 06	6 06	6 06	6 06
23	5 59	5 59	5 59	5 58	5 58	5 57	5 57	5 56	5 55	5 55	5 54	5 53	5 52	5 50
27	5 53	5 52	5 51	5 50	5 49	5 48	5 47	5 46	5 45	5 43	5 42	5 40	5 38	5 35
31	5 46	5 45	5 44	5 43	5 41	5 40	5 38	5 36	5 34	5 32	5 30	5 27	5 23	5 20
Apr. 4	5 40	5 38	5 37	5 35	5 33	5 31	5 29	5 27	5 24	5 21	5 17	5 14	5 09	5 04

SUNSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan. -2	16 43	16 37	16 30	16 22	16 14	16 06	15 56	15 45	15 33	15 18	15 01	14 40	14 12	13 32
2	16 46	16 40	16 33	16 26	16 18	16 10	16 00	15 49	15 37	15 23	15 06	14 46	14 19	13 42
6	16 50	16 44	16 37	16 30	16 22	16 14	16 05	15 54	15 42	15 29	15 13	14 53	14 28	13 54
10	16 53	16 48	16 41	16 35	16 27	16 19	16 10	16 00	15 49	15 36	15 20	15 02	14 39	14 07
14	16 58	16 52	16 46	16 39	16 32	16 25	16 16	16 06	15 56	15 43	15 29	15 11	14 50	14 22
18	17 02	16 57	16 51	16 45	16 38	16 31	16 22	16 13	16 03	15 52	15 38	15 22	15 02	14 37
22	17 07	17 02	16 56	16 50	16 44	16 37	16 29	16 21	16 11	16 00	15 48	15 33	15 15	14 52
26	17 11	17 07	17 02	16 56	16 50	16 43	16 36	16 28	16 19	16 09	15 58	15 44	15 28	15 08
30	17 16	17 12	17 07	17 02	16 56	16 50	16 44	16 36	16 28	16 19	16 08	15 56	15 41	15 23
Feb. 3	17 21	17 17	17 12	17 08	17 03	16 57	16 51	16 44	16 37	16 28	16 19	16 07	15 54	15 38
7	17 26	17 22	17 18	17 14	17 09	17 04	16 58	16 52	16 45	16 38	16 29	16 19	16 07	15 53
11	17 31	17 27	17 24	17 20	17 15	17 11	17 06	17 00	16 54	16 47	16 40	16 31	16 20	16 08
15	17 35	17 32	17 29	17 26	17 22	17 18	17 13	17 08	17 03	16 57	16 50	16 42	16 33	16 23
19	17 40	17 37	17 34	17 31	17 28	17 25	17 21	17 16	17 12	17 07	17 01	16 54	16 46	16 37
23	17 45	17 42	17 40	17 37	17 34	17 31	17 28	17 24	17 20	17 16	17 11	17 05	16 59	16 51
27	17 49	17 47	17 45	17 43	17 41	17 38	17 35	17 32	17 29	17 25	17 21	17 17	17 11	17 05
Mar. 3	17 54	17 52	17 50	17 49	17 47	17 45	17 43	17 40	17 38	17 35	17 31	17 28	17 24	17 19
7	17 58	17 57	17 56	17 54	17 53	17 51	17 50	17 48	17 46	17 44	17 41	17 39	17 36	17 32
11	18 02	18 01	18 01	18 00	17 59	17 58	17 57	17 56	17 54	17 53	17 51	17 50	17 48	17 45
15	18 06	18 06	18 06	18 05	18 05	18 04	18 04	18 03	18 03	18 02	18 01	18 01	18 00	17 59
19	18 11	18 11	18 11	18 11	18 11	18 11	18 11	18 11	18 11	18 11	18 11	18 11	18 12	18 12
23	18 15	18 15	18 16	18 16	18 17	18 17	18 18	18 18	18 19	18 20	18 21	18 22	18 23	18 25
27	18 19	18 20	18 20	18 21	18 22	18 23	18 25	18 26	18 27	18 29	18 31	18 33	18 35	18 38
31	18 23	18 24	18 25	18 27	18 28	18 30	18 31	18 33	18 35	18 38	18 40	18 43	18 47	18 51
Apr. 4	18 27	18 28	18 30	18 32	18 34	18 36	18 38	18 41	18 44	18 47	18 50	18 54	18 59	19 04

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH
SUNRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Mar. 31	6 22	6 18	6 16	6 14	6 12	6 10	6 07	6 04	6 01	5 58	5 55	5 51	5 49	5 46
Apr. 4	6 29	6 25	6 21	6 18	6 15	6 12	6 08	6 04	6 00	5 56	5 51	5 46	5 43	5 40
8	6 37	6 31	6 26	6 22	6 18	6 15	6 09	6 04	5 59	5 54	5 48	5 42	5 38	5 34
12	6 45	6 37	6 31	6 26	6 21	6 17	6 10	6 04	5 58	5 51	5 45	5 37	5 33	5 27
16	6 52	6 43	6 36	6 30	6 24	6 19	6 11	6 04	5 57	5 49	5 42	5 33	5 27	5 21
20	7 00	6 49	6 41	6 34	6 27	6 22	6 12	6 04	5 56	5 47	5 39	5 28	5 22	5 16
24	7 08	6 55	6 46	6 38	6 31	6 24	6 14	6 04	5 55	5 46	5 36	5 24	5 18	5 10
28	7 15	7 02	6 51	6 42	6 34	6 27	6 15	6 04	5 54	5 44	5 33	5 20	5 13	5 05
May 2	7 23	7 07	6 55	6 45	6 37	6 29	6 16	6 05	5 54	5 42	5 31	5 17	5 09	4 59
6	7 30	7 13	7 00	6 49	6 40	6 32	6 18	6 05	5 53	5 41	5 28	5 13	5 05	4 55
10	7 37	7 19	7 05	6 53	6 43	6 34	6 19	6 06	5 53	5 40	5 26	5 10	5 01	4 50
14	7 44	7 25	7 10	6 57	6 46	6 37	6 21	6 06	5 53	5 39	5 24	5 08	4 58	4 46
18	7 51	7 30	7 14	7 01	6 49	6 39	6 22	6 07	5 53	5 38	5 23	5 05	4 55	4 43
22	7 57	7 35	7 18	7 04	6 52	6 42	6 24	6 08	5 53	5 38	5 22	5 03	4 52	4 39
26	8 03	7 40	7 22	7 08	6 55	6 44	6 25	6 09	5 53	5 38	5 21	5 01	4 50	4 37
30	8 09	7 45	7 26	7 11	6 58	6 46	6 27	6 10	5 54	5 38	5 20	5 00	4 48	4 34
June 3	8 14	7 49	7 29	7 14	7 00	6 49	6 28	6 11	5 54	5 38	5 20	4 59	4 47	4 33
7	8 18	7 52	7 32	7 16	7 02	6 50	6 30	6 12	5 55	5 38	5 20	4 58	4 46	4 31
11	8 22	7 55	7 35	7 18	7 04	6 52	6 31	6 13	5 56	5 39	5 20	4 58	4 46	4 31
15	8 24	7 57	7 37	7 20	7 06	6 54	6 33	6 14	5 57	5 39	5 20	4 58	4 46	4 31
19	8 26	7 59	7 38	7 21	7 07	6 55	6 34	6 15	5 58	5 40	5 21	4 59	4 46	4 31
23	8 27	8 00	7 39	7 22	7 08	6 56	6 34	6 16	5 58	5 41	5 22	5 00	4 47	4 32
27	8 27	8 00	7 39	7 23	7 09	6 56	6 35	6 17	5 59	5 42	5 23	5 01	4 48	4 33
July 1	8 26	8 00	7 39	7 23	7 09	6 57	6 36	6 17	6 00	5 43	5 24	5 02	4 50	4 35
5	8 24	7 58	7 38	7 22	7 08	6 56	6 36	6 18	6 01	5 44	5 25	5 04	4 51	4 37

SUNSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Mar. 31	17 46	17 49	17 52	17 54	17 56	17 58	18 02	18 05	18 08	18 11	18 14	18 18	18 20	18 23
Apr. 4	17 36	17 41	17 45	17 48	17 51	17 53	17 58	18 02	18 06	18 10	18 15	18 20	18 23	18 27
8	17 26	17 32	17 37	17 42	17 45	17 49	17 55	18 00	18 05	18 10	18 16	18 23	18 27	18 31
12	17 16	17 24	17 30	17 36	17 40	17 44	17 52	17 58	18 04	18 10	18 17	18 25	18 30	18 35
16	17 06	17 16	17 23	17 30	17 35	17 40	17 48	17 56	18 03	18 11	18 18	18 28	18 33	18 39
20	16 57	17 08	17 17	17 24	17 30	17 36	17 45	17 54	18 02	18 11	18 20	18 30	18 36	18 43
24	16 48	17 00	17 10	17 18	17 25	17 32	17 43	17 52	18 02	18 11	18 21	18 33	18 39	18 47
28	16 39	16 53	17 04	17 13	17 21	17 28	17 40	17 51	18 01	18 11	18 22	18 35	18 43	18 51
May 2	16 31	16 46	16 58	17 08	17 17	17 24	17 38	17 49	18 00	18 12	18 24	18 38	18 46	18 55
6	16 23	16 39	16 52	17 03	17 13	17 21	17 35	17 48	18 00	18 12	18 25	18 40	18 49	18 59
10	16 15	16 33	16 47	16 59	17 09	17 18	17 34	17 47	18 00	18 13	18 27	18 43	18 52	19 03
14	16 08	16 27	16 43	16 55	17 06	17 15	17 32	17 46	18 00	18 14	18 28	18 46	18 56	19 07
18	16 01	16 22	16 38	16 52	17 03	17 13	17 30	17 46	18 00	18 14	18 30	18 48	18 59	19 11
22	15 56	16 17	16 35	16 49	17 01	17 11	17 29	17 45	18 00	18 15	18 32	18 51	19 02	19 14
26	15 50	16 13	16 31	16 46	16 59	17 10	17 28	17 45	18 01	18 16	18 33	18 53	19 05	19 18
30	15 46	16 10	16 29	16 44	16 57	17 08	17 28	17 45	18 01	18 17	18 35	18 55	19 07	19 21
June 3	15 42	16 07	16 27	16 42	16 56	17 08	17 28	17 45	18 02	18 18	18 36	18 57	19 10	19 24
7	15 39	16 05	16 25	16 41	16 55	17 07	17 28	17 46	18 02	18 20	18 38	18 59	19 12	19 26
11	15 37	16 04	16 24	16 41	16 55	17 07	17 28	17 46	18 03	18 21	18 39	19 01	19 14	19 29
15	15 36	16 03	16 24	16 41	16 55	17 07	17 28	17 47	18 04	18 22	18 40	19 02	19 15	19 30
19	15 36	16 04	16 24	16 41	16 55	17 08	17 29	17 48	18 05	18 23	18 42	19 04	19 17	19 32
23	15 37	16 04	16 25	16 42	16 56	17 09	17 30	17 48	18 06	18 23	18 42	19 04	19 18	19 33
27	15 39	16 06	16 27	16 43	16 57	17 10	17 31	17 49	18 07	18 24	18 43	19 05	19 18	19 33
July 1	15 42	16 08	16 29	16 45	16 59	17 11	17 32	17 50	18 07	18 25	18 43	19 05	19 18	19 33
5	15 45	16 11	16 31	16 47	17 01	17 13	17 33	17 51	18 08	18 25	18 44	19 05	19 18	19 32

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

SUNRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Mar. 31	5 46	5 45	5 44	5 43	5 41	5 40	5 38	5 36	5 34	5 32	5 30	5 27	5 23	5 20
Apr. 4	5 40	5 38	5 37	5 35	5 33	5 31	5 29	5 27	5 24	5 21	5 17	5 14	5 09	5 04
8	5 34	5 32	5 30	5 28	5 25	5 23	5 20	5 17	5 13	5 10	5 05	5 01	4 55	4 49
12	5 27	5 25	5 23	5 20	5 17	5 14	5 11	5 07	5 03	4 59	4 53	4 48	4 41	4 33
16	5 21	5 19	5 16	5 13	5 10	5 06	5 02	4 58	4 53	4 48	4 42	4 35	4 27	4 18
20	5 16	5 13	5 09	5 06	5 02	4 58	4 53	4 49	4 43	4 37	4 30	4 22	4 13	4 02
24	5 10	5 06	5 03	4 59	4 55	4 50	4 45	4 40	4 33	4 26	4 19	4 09	3 59	3 46
28	5 05	5 01	4 57	4 52	4 48	4 43	4 37	4 31	4 24	4 16	4 07	3 57	3 45	3 31
May 2	4 59	4 55	4 51	4 46	4 41	4 35	4 29	4 22	4 15	4 06	3 56	3 45	3 31	3 15
6	4 55	4 50	4 45	4 40	4 35	4 29	4 22	4 14	4 06	3 57	3 46	3 33	3 18	2 59
10	4 50	4 45	4 40	4 35	4 29	4 22	4 15	4 07	3 58	3 47	3 35	3 21	3 05	2 43
14	4 46	4 41	4 36	4 30	4 23	4 16	4 08	4 00	3 50	3 39	3 26	3 10	2 51	2 28
18	4 43	4 37	4 31	4 25	4 18	4 11	4 02	3 53	3 43	3 30	3 16	3 00	2 39	2 12
22	4 39	4 34	4 28	4 21	4 14	4 06	3 57	3 47	3 36	3 23	3 08	2 50	2 27	1 55
26	4 37	4 31	4 24	4 17	4 10	4 01	3 52	3 42	3 30	3 16	3 00	2 40	2 15	1 39
30	4 34	4 28	4 22	4 14	4 06	3 58	3 48	3 37	3 25	3 10	2 53	2 32	2 04	1 22
June 3	4 33	4 26	4 19	4 12	4 04	3 55	3 45	3 33	3 20	3 05	2 47	2 24	1 54	1 05
7	4 31	4 25	4 18	4 10	4 02	3 53	3 42	3 30	3 17	3 01	2 42	2 18	1 45	0 47
11	4 31	4 24	4 17	4 09	4 00	3 51	3 40	3 28	3 15	2 58	2 39	2 14	1 38	0 24
15	4 31	4 24	4 17	4 09	4 00	3 50	3 39	3 27	3 13	2 57	2 36	2 10	1 34	□
19	4 31	4 24	4 17	4 09	4 00	3 50	3 39	3 27	3 13	2 56	2 36	2 09	1 31	□
23	4 32	4 25	4 18	4 10	4 01	3 51	3 40	3 28	3 14	2 57	2 36	2 10	1 32	□
27	4 33	4 26	4 19	4 11	4 02	3 53	3 42	3 29	3 15	2 59	2 38	2 12	1 35	□
July 1	4 35	4 28	4 21	4 13	4 04	3 55	3 44	3 32	3 18	3 02	2 42	2 16	1 41	0 16
5	4 37	4 30	4 23	4 15	4 07	3 58	3 47	3 35	3 22	3 06	2 46	2 22	1 48	0 45

SUNSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Mar. 31	18 23	18 24	18 25	18 27	18 28	18 30	18 31	18 33	18 35	18 38	18 40	18 43	18 47	18 51
Apr. 4	18 27	18 28	18 30	18 32	18 34	18 36	18 38	18 41	18 44	18 47	18 50	18 54	18 59	19 04
8	18 31	18 33	18 35	18 37	18 40	18 42	18 45	18 48	18 52	18 56	19 00	19 05	19 11	19 17
12	18 35	18 37	18 40	18 42	18 45	18 48	18 52	18 56	19 00	19 05	19 10	19 16	19 23	19 31
16	18 39	18 42	18 45	18 48	18 51	18 55	18 59	19 03	19 08	19 14	19 20	19 27	19 35	19 45
20	18 43	18 46	18 49	18 53	18 57	19 01	19 06	19 11	19 16	19 23	19 30	19 38	19 47	19 58
24	18 47	18 51	18 54	18 58	19 03	19 07	19 12	19 18	19 24	19 32	19 40	19 49	20 00	20 13
28	18 51	18 55	18 59	19 04	19 08	19 14	19 19	19 26	19 33	19 40	19 50	20 00	20 12	20 27
May 2	18 55	18 59	19 04	19 09	19 14	19 20	19 26	19 33	19 41	19 49	19 59	20 11	20 25	20 42
6	18 59	19 04	19 09	19 14	19 20	19 26	19 33	19 40	19 49	19 58	20 09	20 22	20 38	20 57
10	19 03	19 08	19 13	19 19	19 25	19 32	19 39	19 47	19 56	20 07	20 19	20 33	20 51	21 12
14	19 07	19 12	19 18	19 24	19 30	19 37	19 45	19 54	20 04	20 15	20 29	20 44	21 04	21 28
18	19 11	19 16	19 22	19 29	19 35	19 43	19 51	20 01	20 12	20 24	20 38	20 55	21 17	21 45
22	19 14	19 20	19 26	19 33	19 40	19 48	19 57	20 07	20 19	20 32	20 47	21 06	21 29	22 01
26	19 18	19 24	19 30	19 37	19 45	19 53	20 03	20 13	20 25	20 39	20 55	21 16	21 42	22 19
30	19 21	19 27	19 34	19 41	19 49	19 58	20 08	20 19	20 31	20 46	21 03	21 25	21 53	22 36
June 3	19 24	19 30	19 37	19 45	19 53	20 02	20 12	20 24	20 37	20 52	21 10	21 33	22 04	22 55
7	19 26	19 33	19 40	19 48	19 56	20 06	20 16	20 28	20 41	20 57	21 16	21 41	22 14	23 16
11	19 29	19 35	19 42	19 50	19 59	20 08	20 19	20 31	20 45	21 01	21 21	21 47	22 22	23 43
15	19 30	19 37	19 44	19 52	20 01	20 11	20 22	20 34	20 48	21 05	21 25	21 51	22 28	□
19	19 32	19 39	19 46	19 54	20 03	20 12	20 23	20 36	20 50	21 07	21 27	21 54	22 32	□
23	19 33	19 39	19 47	19 55	20 03	20 13	20 24	20 36	20 51	21 07	21 28	21 54	22 32	□
27	19 33	19 40	19 47	19 55	20 04	20 13	20 24	20 36	20 50	21 07	21 27	21 53	22 30	□
July 1	19 33	19 39	19 47	19 54	20 03	20 13	20 23	20 35	20 49	21 05	21 25	21 50	22 26	23 42
5	19 32	19 39	19 46	19 53	20 02	20 11	20 21	20 33	20 47	21 03	21 22	21 46	22 19	23 19

□ indicates Sun continuously above horizon.

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

SUNRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July	1	8 26	8 00	7 39	7 23	7 09	6 57	6 36	6 17	6 00	5 43	5 24	5 02	4 50
	5	8 24	7 58	7 38	7 22	7 08	6 56	6 36	6 18	6 01	5 44	5 25	5 04	4 51
	9	8 22	7 56	7 37	7 21	7 08	6 56	6 36	6 18	6 02	5 45	5 27	5 06	4 53
	13	8 18	7 54	7 35	7 19	7 06	6 55	6 35	6 18	6 02	5 46	5 28	5 08	4 56
	17	8 13	7 50	7 32	7 17	7 05	6 54	6 35	6 18	6 03	5 47	5 30	5 10	4 58
	21	8 08	7 46	7 29	7 15	7 03	6 52	6 34	6 18	6 03	5 48	5 31	5 12	5 01
	25	8 02	7 41	7 25	7 12	7 00	6 50	6 33	6 17	6 03	5 48	5 33	5 15	5 04
	29	7 56	7 36	7 21	7 08	6 57	6 48	6 31	6 17	6 03	5 49	5 34	5 17	5 07
	Aug. 2	7 49	7 30	7 16	7 04	6 54	6 45	6 29	6 16	6 03	5 50	5 36	5 19	5 10
	6	7 41	7 24	7 11	7 00	6 50	6 42	6 27	6 15	6 02	5 50	5 37	5 22	5 13
	10	7 33	7 18	7 05	6 55	6 46	6 39	6 25	6 13	6 02	5 51	5 38	5 24	5 16
	14	7 25	7 11	6 59	6 50	6 42	6 35	6 23	6 12	6 01	5 51	5 40	5 27	5 19
	18	7 16	7 03	6 53	6 45	6 37	6 31	6 20	6 10	6 01	5 51	5 41	5 29	5 22
	22	7 07	6 56	6 47	6 39	6 33	6 27	6 17	6 08	6 00	5 51	5 42	5 31	5 25
	26	6 57	6 48	6 40	6 33	6 28	6 23	6 14	6 06	5 59	5 51	5 43	5 33	5 28
	30	6 48	6 39	6 33	6 27	6 22	6 18	6 11	6 04	5 57	5 51	5 44	5 36	5 31
	Sept. 3	6 38	6 31	6 26	6 21	6 17	6 13	6 07	6 02	5 56	5 51	5 45	5 38	5 34
	7	6 28	6 23	6 18	6 15	6 11	6 09	6 04	5 59	5 55	5 50	5 46	5 40	5 37
	11	6 18	6 14	6 11	6 08	6 06	6 04	6 00	5 57	5 53	5 50	5 46	5 42	5 40
	15	6 08	6 05	6 03	6 02	6 00	5 59	5 56	5 54	5 52	5 50	5 47	5 44	5 40
	19	5 57	5 56	5 56	5 55	5 54	5 54	5 53	5 52	5 51	5 49	5 48	5 46	5 45
	23	5 47	5 48	5 48	5 48	5 49	5 49	5 49	5 49	5 49	5 49	5 49	5 49	5 48
	27	5 37	5 39	5 40	5 42	5 43	5 44	5 45	5 47	5 48	5 49	5 50	5 51	5 51
	Oct. 1	5 26	5 30	5 33	5 35	5 37	5 39	5 42	5 44	5 46	5 49	5 51	5 53	5 54
	5	5 16	5 21	5 25	5 29	5 32	5 34	5 38	5 42	5 45	5 48	5 52	5 55	5 57

SUNSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July	1	15 42	16 08	16 29	16 45	16 59	17 11	17 32	17 50	18 07	18 25	18 43	19 05	19 18
	5	15 45	16 11	16 31	16 47	17 01	17 13	17 33	17 51	18 08	18 25	18 44	19 05	19 18
	9	15 49	16 14	16 34	16 50	17 03	17 15	17 35	17 52	18 09	18 25	18 43	19 04	19 17
	13	15 54	16 18	16 37	16 52	17 05	17 17	17 36	17 53	18 09	18 26	18 43	19 03	19 15
	17	15 59	16 22	16 40	16 55	17 08	17 19	17 38	17 54	18 10	18 25	18 42	19 02	19 14
	21	16 05	16 27	16 44	16 58	17 10	17 21	17 39	17 55	18 10	18 25	18 41	19 00	19 11
	25	16 11	16 32	16 48	17 02	17 13	17 23	17 41	17 56	18 10	18 25	18 40	18 58	19 09
	29	16 18	16 37	16 53	17 05	17 16	17 26	17 42	17 56	18 10	18 24	18 39	18 56	19 06
	Aug. 2	16 24	16 43	16 57	17 09	17 19	17 28	17 43	17 57	18 10	18 23	18 37	18 53	19 02
	6	16 31	16 48	17 01	17 12	17 22	17 30	17 45	17 57	18 09	18 21	18 35	18 50	18 59
	10	16 38	16 54	17 06	17 16	17 25	17 33	17 46	17 58	18 09	18 20	18 32	18 46	18 54
	14	16 46	17 00	17 11	17 20	17 28	17 35	17 47	17 58	18 08	18 18	18 30	18 42	18 50
	18	16 53	17 05	17 15	17 24	17 31	17 37	17 48	17 58	18 07	18 17	18 27	18 39	18 45
	22	17 00	17 11	17 20	17 27	17 34	17 39	17 49	17 58	18 06	18 15	18 24	18 34	18 40
	26	17 07	17 17	17 25	17 31	17 37	17 42	17 50	17 58	18 05	18 13	18 21	18 30	18 35
	30	17 15	17 23	17 29	17 35	17 40	17 44	17 51	17 58	18 04	18 10	18 17	18 25	18 30
	Sept. 3	17 22	17 29	17 34	17 38	17 42	17 46	17 52	17 57	18 03	18 08	18 14	18 21	18 25
	7	17 29	17 35	17 39	17 42	17 45	17 48	17 53	17 57	18 01	18 06	18 10	18 16	18 19
	11	17 37	17 40	17 43	17 46	17 48	17 50	17 54	17 57	18 00	18 03	18 07	18 11	18 13
	15	17 44	17 46	17 48	17 50	17 51	17 52	17 54	17 57	17 59	18 01	18 03	18 06	18 08
	19	17 52	17 52	17 53	17 53	17 54	17 54	17 55	17 56	17 57	17 58	17 59	18 01	18 02
	23	17 59	17 58	17 58	17 57	17 57	17 57	17 56	17 56	17 56	17 56	17 56	17 56	17 56
	27	18 07	18 04	18 03	18 01	18 00	17 59	17 57	17 56	17 54	17 53	17 52	17 51	17 50
	Oct. 1	18 14	18 10	18 07	18 05	18 03	18 01	17 58	17 55	17 53	17 51	17 48	17 46	17 45
	5	18 22	18 17	18 12	18 09	18 06	18 03	17 59	17 55	17 52	17 48	17 45	17 41	17 39

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

SUNRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 1	4 35	4 28	4 21	4 13	4 04	3 55	3 44	3 32	3 18	3 02	2 42	2 16	1 41	0 16
5	4 37	4 30	4 23	4 15	4 07	3 58	3 47	3 35	3 22	3 06	2 46	2 22	1 48	0 45
9	4 39	4 33	4 26	4 18	4 10	4 01	3 51	3 39	3 26	3 11	2 52	2 29	1 58	1 06
13	4 42	4 36	4 29	4 22	4 14	4 05	3 55	3 44	3 31	3 17	2 59	2 37	2 09	1 25
17	4 45	4 39	4 32	4 25	4 18	4 09	4 00	3 49	3 37	3 23	3 07	2 46	2 20	1 43
21	4 48	4 42	4 36	4 30	4 22	4 14	4 05	3 55	3 44	3 31	3 15	2 56	2 32	2 00
25	4 52	4 46	4 40	4 34	4 27	4 19	4 11	4 01	3 51	3 38	3 24	3 06	2 45	2 16
29	4 55	4 50	4 44	4 38	4 32	4 25	4 17	4 08	3 58	3 46	3 33	3 17	2 57	2 32
Aug. 2	4 59	4 54	4 49	4 43	4 37	4 30	4 23	4 14	4 05	3 54	3 42	3 28	3 10	2 48
6	5 03	4 58	4 53	4 48	4 42	4 36	4 29	4 21	4 13	4 03	3 52	3 38	3 23	3 03
10	5 06	5 02	4 58	4 53	4 47	4 42	4 35	4 28	4 20	4 11	4 01	3 49	3 35	3 18
14	5 10	5 06	5 02	4 58	4 53	4 48	4 42	4 35	4 28	4 20	4 11	4 00	3 48	3 32
18	5 14	5 10	5 07	5 03	4 58	4 53	4 48	4 42	4 36	4 29	4 20	4 11	4 00	3 47
22	5 18	5 15	5 11	5 08	5 04	4 59	4 55	4 50	4 44	4 37	4 30	4 22	4 12	4 00
26	5 22	5 19	5 16	5 13	5 09	5 05	5 01	4 57	4 52	4 46	4 40	4 32	4 24	4 14
30	5 25	5 23	5 20	5 18	5 15	5 11	5 08	5 04	5 00	4 55	4 49	4 43	4 36	4 27
Sept. 3	5 29	5 27	5 25	5 23	5 20	5 17	5 14	5 11	5 07	5 03	4 59	4 53	4 47	4 40
7	5 33	5 31	5 29	5 28	5 26	5 23	5 21	5 18	5 15	5 12	5 08	5 04	4 59	4 53
11	5 37	5 35	5 34	5 33	5 31	5 29	5 27	5 25	5 23	5 20	5 17	5 14	5 10	5 06
15	5 40	5 40	5 39	5 38	5 36	5 35	5 34	5 32	5 31	5 29	5 27	5 25	5 22	5 19
19	5 44	5 44	5 43	5 43	5 42	5 41	5 40	5 40	5 39	5 37	5 36	5 35	5 33	5 31
23	5 48	5 48	5 48	5 48	5 47	5 47	5 47	5 47	5 46	5 46	5 46	5 45	5 45	5 44
27	5 52	5 52	5 52	5 53	5 53	5 53	5 54	5 54	5 54	5 55	5 55	5 55	5 56	5 57
Oct. 1	5 56	5 56	5 57	5 58	5 59	5 59	6 00	6 01	6 02	6 03	6 04	6 06	6 07	6 09
5	6 00	6 01	6 02	6 03	6 04	6 05	6 07	6 08	6 10	6 12	6 14	6 16	6 19	6 22

SUNSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 1	19 33	19 39	19 47	19 54	20 03	20 13	20 23	20 35	20 49	21 05	21 25	21 50	22 26	23 42
5	19 32	19 39	19 46	19 53	20 02	20 11	20 21	20 33	20 47	21 03	21 22	21 46	22 19	23 19
9	19 31	19 37	19 44	19 52	20 00	20 09	20 19	20 30	20 43	20 59	21 17	21 40	22 10	23 00
13	19 29	19 35	19 42	19 49	19 57	20 06	20 16	20 27	20 39	20 54	21 11	21 32	22 01	22 43
17	19 27	19 33	19 39	19 46	19 54	20 02	20 12	20 22	20 34	20 48	21 04	21 24	21 50	22 26
21	19 24	19 30	19 36	19 43	19 50	19 58	20 07	20 17	20 28	20 41	20 56	21 15	21 38	22 10
25	19 21	19 26	19 32	19 39	19 45	19 53	20 01	20 11	20 21	20 34	20 48	21 05	21 26	21 54
29	19 17	19 22	19 28	19 34	19 40	19 48	19 55	20 04	20 14	20 25	20 39	20 54	21 13	21 38
Aug. 2	19 13	19 18	19 23	19 29	19 35	19 41	19 49	19 57	20 06	20 17	20 29	20 43	21 00	21 22
6	19 09	19 13	19 18	19 23	19 29	19 35	19 42	19 49	19 58	20 07	20 19	20 31	20 47	21 06
10	19 04	19 08	19 12	19 17	19 22	19 28	19 34	19 41	19 49	19 58	20 08	20 20	20 33	20 50
14	18 59	19 02	19 07	19 11	19 16	19 21	19 27	19 33	19 40	19 48	19 57	20 07	20 20	20 34
18	18 53	18 57	19 00	19 04	19 09	19 13	19 18	19 24	19 30	19 38	19 46	19 55	20 06	20 19
22	18 47	18 51	18 54	18 57	19 01	19 05	19 10	19 15	19 21	19 27	19 34	19 42	19 52	20 03
26	18 41	18 44	18 47	18 50	18 54	18 57	19 01	19 06	19 11	19 16	19 22	19 30	19 38	19 47
30	18 35	18 38	18 40	18 43	18 46	18 49	18 53	18 56	19 01	19 05	19 11	19 17	19 24	19 32
Sept. 3	18 29	18 31	18 33	18 35	18 38	18 41	18 43	18 47	18 50	18 54	18 59	19 04	19 10	19 16
7	18 23	18 24	18 26	18 28	18 30	18 32	18 34	18 37	18 40	18 43	18 47	18 51	18 55	19 01
11	18 16	18 17	18 19	18 20	18 22	18 23	18 25	18 27	18 29	18 32	18 34	18 38	18 41	18 45
15	18 09	18 10	18 11	18 12	18 13	18 14	18 16	18 17	18 19	18 20	18 22	18 25	18 27	18 30
19	18 03	18 03	18 04	18 04	18 05	18 06	18 06	18 07	18 08	18 09	18 10	18 11	18 13	18 15
23	17 56	17 56	17 56	17 57	17 57	17 57	17 57	17 57	17 57	17 58	17 58	17 58	17 59	17 59
27	17 50	17 49	17 49	17 49	17 48	17 48	17 48	17 47	17 47	17 46	17 46	17 45	17 45	17 44
Oct. 1	17 43	17 42	17 42	17 41	17 40	17 39	17 38	17 37	17 36	17 35	17 34	17 32	17 31	17 29
5	17 37	17 36	17 34	17 33	17 32	17 31	17 29	17 28	17 26	17 24	17 22	17 19	17 16	17 13

SUNRISE AND SUNSET, 2015
UNIVERSAL TIME FOR MERIDIAN OF GREENWICH
SUNRISE

Lat.		−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct.	1	5 26	5 30	5 33	5 35	5 37	5 39	5 42	5 44	5 46	5 49	5 51	5 53	5 54	5 56
	5	5 16	5 21	5 25	5 29	5 32	5 34	5 38	5 42	5 45	5 48	5 52	5 55	5 57	6 00
	9	5 06	5 13	5 18	5 22	5 26	5 29	5 35	5 40	5 44	5 48	5 53	5 58	6 01	6 04
	13	4 56	5 04	5 11	5 16	5 21	5 25	5 32	5 38	5 43	5 48	5 54	6 00	6 04	6 08
	17	4 46	4 56	5 04	5 10	5 15	5 20	5 28	5 36	5 42	5 49	5 55	6 03	6 07	6 12
Nov.	21	4 37	4 48	4 57	5 04	5 10	5 16	5 26	5 34	5 41	5 49	5 57	6 06	6 11	6 16
	25	4 27	4 40	4 50	4 59	5 06	5 12	5 23	5 32	5 41	5 49	5 58	6 08	6 14	6 21
	29	4 18	4 33	4 44	4 53	5 01	5 08	5 20	5 31	5 40	5 50	6 00	6 11	6 18	6 25
	2	4 10	4 25	4 38	4 48	4 57	5 05	5 18	5 30	5 40	5 51	6 02	6 14	6 22	6 30
	6	4 01	4 19	4 32	4 44	4 53	5 02	5 16	5 29	5 40	5 52	6 04	6 17	6 25	6 34
Dec.	10	3 53	4 12	4 27	4 40	4 50	4 59	5 14	5 28	5 40	5 53	6 06	6 21	6 29	6 39
	14	3 46	4 07	4 23	4 36	4 47	4 57	5 13	5 28	5 41	5 54	6 08	6 24	6 33	6 43
	18	3 39	4 01	4 19	4 33	4 44	4 55	5 12	5 27	5 42	5 56	6 10	6 27	6 37	6 48
	22	3 33	3 57	4 15	4 30	4 42	4 53	5 12	5 28	5 42	5 57	6 13	6 31	6 41	6 53
	26	3 28	3 53	4 12	4 28	4 41	4 52	5 11	5 28	5 44	5 59	6 15	6 34	6 45	6 57
Dec.	30	3 23	3 50	4 10	4 26	4 40	4 51	5 11	5 29	5 45	6 01	6 18	6 37	6 48	7 01
	4	3 20	3 47	4 08	4 25	4 39	4 51	5 12	5 30	5 46	6 03	6 20	6 40	6 52	7 05
	8	3 17	3 46	4 07	4 24	4 39	4 51	5 13	5 31	5 48	6 05	6 23	6 43	6 55	7 09
	12	3 16	3 45	4 07	4 25	4 39	4 52	5 14	5 33	5 50	6 07	6 25	6 46	6 58	7 12
	16	3 15	3 45	4 08	4 26	4 40	4 53	5 15	5 34	5 52	6 09	6 28	6 49	7 01	7 15
	20	3 16	3 46	4 09	4 27	4 42	4 55	5 17	5 36	5 54	6 11	6 30	6 51	7 03	7 18
	24	3 18	3 48	4 11	4 29	4 44	4 57	5 19	5 38	5 56	6 13	6 32	6 53	7 05	7 19
	28	3 21	3 51	4 13	4 31	4 46	4 59	5 21	5 40	5 58	6 15	6 33	6 55	7 07	7 21
	32	3 25	3 55	4 17	4 34	4 49	5 02	5 24	5 42	6 00	6 17	6 35	6 56	7 08	7 22
	36	3 31	3 59	4 21	4 38	4 52	5 05	5 26	5 44	6 01	6 18	6 36	6 57	7 08	7 22

SUNSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct.	1	18 14	18 10	18 07	18 05	18 03	18 01	17 58	17 55	17 53	17 51	17 48	17 46	17 45	17 43
	5	18 22	18 17	18 12	18 09	18 06	18 03	17 59	17 55	17 52	17 48	17 45	17 41	17 39	17 37
	9	18 30	18 23	18 18	18 13	18 09	18 06	18 00	17 55	17 51	17 46	17 42	17 36	17 34	17 30
	13	18 38	18 29	18 23	18 17	18 13	18 08	18 01	17 55	17 50	17 44	17 38	17 32	17 28	17 24
	17	18 46	18 36	18 28	18 22	18 16	18 11	18 03	17 55	17 49	17 42	17 35	17 28	17 23	17 18
Nov.	21	18 54	18 43	18 33	18 26	18 19	18 14	18 04	17 56	17 48	17 40	17 32	17 23	17 18	17 12
	25	19 02	18 49	18 39	18 30	18 23	18 17	18 06	17 56	17 47	17 39	17 30	17 19	17 14	17 07
	29	19 11	18 56	18 44	18 35	18 27	18 20	18 07	17 57	17 47	17 37	17 27	17 16	17 09	17 02
	2	19 19	19 03	18 50	18 39	18 31	18 23	18 09	17 58	17 47	17 36	17 25	17 12	17 05	16 57
	6	19 27	19 10	18 56	18 44	18 34	18 26	18 11	17 59	17 47	17 36	17 23	17 09	17 02	16 53
Dec.	10	19 36	19 16	19 01	18 49	18 38	18 29	18 14	18 00	17 47	17 35	17 22	17 07	16 58	16 48
	14	19 44	19 23	19 07	18 54	18 42	18 33	18 16	18 01	17 48	17 35	17 21	17 05	16 55	16 45
	18	19 52	19 30	19 12	18 58	18 46	18 36	18 18	18 03	17 49	17 35	17 20	17 03	16 53	16 42
	22	20 00	19 36	19 18	19 03	18 50	18 39	18 21	18 05	17 50	17 35	17 19	17 01	16 51	16 39
	26	20 08	19 42	19 23	19 07	18 54	18 43	18 23	18 06	17 51	17 35	17 19	17 00	16 50	16 37
Dec.	30	20 15	19 48	19 28	19 12	18 58	18 46	18 26	18 08	17 52	17 36	17 19	17 00	16 49	16 36
	4	20 21	19 54	19 32	19 16	19 01	18 49	18 28	18 10	17 54	17 37	17 20	17 00	16 48	16 35
	8	20 27	19 58	19 37	19 19	19 05	18 52	18 31	18 12	17 55	17 39	17 21	17 00	16 48	16 35
	12	20 32	20 02	19 40	19 23	19 08	18 55	18 33	18 15	17 57	17 40	17 22	17 01	16 49	16 35
	16	20 36	20 06	19 44	19 26	19 11	18 58	18 36	18 17	17 59	17 42	17 23	17 02	16 50	16 36
	20	20 39	20 09	19 46	19 28	19 13	19 00	18 38	18 19	18 01	17 44	17 25	17 04	16 52	16 37
	24	20 41	20 10	19 48	19 30	19 15	19 02	18 40	18 21	18 03	17 46	17 27	17 06	16 54	16 39
	28	20 41	20 11	19 49	19 31	19 16	19 03	18 41	18 23	18 05	17 48	17 29	17 08	16 56	16 42
	32	20 41	20 12	19 50	19 32	19 17	19 05	18 43	18 24	18 07	17 50	17 32	17 11	16 59	16 45
	36	20 39	20 11	19 49	19 32	19 18	19 05	18 44	18 26	18 09	17 52	17 34	17 14	17 02	16 48

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

SUNRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 1	5 56	5 56	5 57	5 58	5 59	5 59	6 00	6 01	6 02	6 03	6 04	6 06	6 07	6 09
5	6 00	6 01	6 02	6 03	6 04	6 05	6 07	6 08	6 10	6 12	6 14	6 16	6 19	6 22
9	6 04	6 05	6 07	6 08	6 10	6 12	6 14	6 16	6 18	6 21	6 24	6 27	6 31	6 35
13	6 08	6 10	6 12	6 14	6 16	6 18	6 21	6 23	6 26	6 30	6 33	6 38	6 43	6 48
17	6 12	6 14	6 17	6 19	6 22	6 24	6 27	6 31	6 35	6 39	6 43	6 49	6 55	7 02
21	6 16	6 19	6 22	6 24	6 28	6 31	6 34	6 38	6 43	6 48	6 53	7 00	7 07	7 15
25	6 21	6 24	6 27	6 30	6 34	6 37	6 42	6 46	6 51	6 57	7 03	7 11	7 19	7 29
29	6 25	6 28	6 32	6 36	6 40	6 44	6 49	6 54	7 00	7 06	7 14	7 22	7 32	7 43
Nov. 2	6 30	6 33	6 37	6 41	6 46	6 51	6 56	7 02	7 08	7 16	7 24	7 33	7 44	7 57
6	6 34	6 38	6 42	6 47	6 52	6 57	7 03	7 10	7 17	7 25	7 34	7 45	7 57	8 12
10	6 39	6 43	6 48	6 53	6 58	7 04	7 10	7 17	7 25	7 34	7 44	7 56	8 10	8 27
14	6 43	6 48	6 53	6 58	7 04	7 10	7 17	7 25	7 34	7 43	7 54	8 07	8 23	8 42
18	6 48	6 53	6 58	7 04	7 10	7 17	7 24	7 33	7 42	7 52	8 04	8 19	8 36	8 57
22	6 53	6 58	7 03	7 09	7 16	7 23	7 31	7 40	7 50	8 01	8 14	8 30	8 48	9 12
26	6 57	7 02	7 08	7 15	7 22	7 29	7 38	7 47	7 57	8 09	8 23	8 40	9 01	9 27
30	7 01	7 07	7 13	7 20	7 27	7 35	7 44	7 53	8 04	8 17	8 32	8 50	9 12	9 42
Dec. 4	7 05	7 11	7 17	7 24	7 32	7 40	7 49	7 59	8 11	8 24	8 40	8 59	9 23	9 56
8	7 09	7 15	7 21	7 29	7 36	7 45	7 54	8 05	8 17	8 31	8 47	9 07	9 33	10 09
12	7 12	7 18	7 25	7 32	7 40	7 49	7 59	8 09	8 22	8 36	8 53	9 14	9 41	10 20
16	7 15	7 21	7 28	7 36	7 44	7 52	8 02	8 13	8 26	8 40	8 58	9 19	9 47	10 28
20	7 18	7 24	7 31	7 38	7 46	7 55	8 05	8 16	8 29	8 44	9 01	9 23	9 51	10 34
24	7 19	7 26	7 33	7 40	7 48	7 57	8 07	8 18	8 31	8 46	9 03	9 25	9 53	10 35
28	7 21	7 27	7 34	7 41	7 49	7 58	8 08	8 19	8 32	8 46	9 03	9 25	9 53	10 34
32	7 22	7 28	7 35	7 42	7 50	7 59	8 08	8 19	8 31	8 46	9 02	9 23	9 50	10 28
36	7 22	7 28	7 35	7 42	7 50	7 58	8 07	8 18	8 30	8 44	9 00	9 20	9 45	10 21

SUNSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 1	17 43	17 42	17 42	17 41	17 40	17 39	17 38	17 37	17 36	17 35	17 34	17 32	17 31	17 29
5	17 37	17 36	17 34	17 33	17 32	17 31	17 29	17 28	17 26	17 24	17 22	17 19	17 16	17 13
9	17 30	17 29	17 27	17 26	17 24	17 22	17 20	17 18	17 15	17 13	17 10	17 06	17 03	16 58
13	17 24	17 22	17 20	17 18	17 16	17 14	17 11	17 08	17 05	17 02	16 58	16 54	16 49	16 43
17	17 18	17 16	17 14	17 11	17 09	17 06	17 03	16 59	16 55	16 51	16 46	16 41	16 35	16 28
21	17 12	17 10	17 07	17 04	17 01	16 58	16 54	16 50	16 46	16 41	16 35	16 29	16 21	16 13
25	17 07	17 04	17 01	16 58	16 54	16 50	16 46	16 41	16 36	16 30	16 24	16 17	16 08	15 58
29	17 02	16 58	16 55	16 51	16 47	16 43	16 38	16 33	16 27	16 20	16 13	16 05	15 55	15 43
Nov. 2	16 57	16 53	16 49	16 45	16 41	16 36	16 30	16 25	16 18	16 11	16 02	15 53	15 42	15 29
6	16 53	16 49	16 44	16 40	16 35	16 29	16 23	16 17	16 10	16 02	15 52	15 42	15 29	15 14
10	16 48	16 44	16 39	16 35	16 29	16 23	16 17	16 10	16 02	15 53	15 43	15 31	15 17	15 00
14	16 45	16 40	16 35	16 30	16 24	16 18	16 11	16 03	15 54	15 45	15 34	15 21	15 05	14 46
18	16 42	16 37	16 31	16 26	16 20	16 13	16 05	15 57	15 48	15 37	15 25	15 11	14 54	14 32
22	16 39	16 34	16 28	16 22	16 16	16 08	16 01	15 52	15 42	15 30	15 17	15 02	14 43	14 19
26	16 37	16 32	16 26	16 19	16 12	16 05	15 56	15 47	15 37	15 24	15 10	14 54	14 33	14 06
30	16 36	16 30	16 24	16 17	16 10	16 02	15 53	15 43	15 32	15 19	15 05	14 47	14 24	13 55
Dec. 4	16 35	16 29	16 22	16 16	16 08	16 00	15 51	15 40	15 29	15 15	15 00	14 41	14 17	13 44
8	16 35	16 28	16 22	16 15	16 07	15 59	15 49	15 38	15 26	15 13	14 56	14 36	14 11	13 34
12	16 35	16 29	16 22	16 15	16 07	15 58	15 48	15 38	15 25	15 11	14 54	14 33	14 06	13 27
16	16 36	16 29	16 23	16 15	16 07	15 58	15 49	15 38	15 25	15 10	14 53	14 32	14 04	13 22
20	16 37	16 31	16 24	16 17	16 09	16 00	15 50	15 39	15 26	15 11	14 54	14 32	14 04	13 21
24	16 39	16 33	16 26	16 19	16 11	16 02	15 52	15 41	15 28	15 13	14 56	14 34	14 06	13 23
28	16 42	16 36	16 29	16 21	16 13	16 05	15 55	15 44	15 31	15 17	14 59	14 38	14 10	13 29
32	16 45	16 39	16 32	16 25	16 17	16 08	15 59	15 48	15 36	15 21	15 04	14 44	14 17	13 38
36	16 48	16 42	16 36	16 29	16 21	16 13	16 03	15 53	15 41	15 27	15 11	14 51	14 25	13 50

MOONRISE AND MOONSET, 2015
UNIVERSAL TIME FOR MERIDIAN OF GREENWICH
MOONRISE

Lat.		-55°	-50°	-45°	-40°	-35°	-30°	-20°	-10°	0°	+10°	+20°	+30°	+35°	+40°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan.	0	15 43	15 28	15 16	15 06	14 57	14 49	14 37	14 25	14 15	14 04	13 53	13 41	13 34	13 25
	1	16 52	16 33	16 19	16 07	15 57	15 48	15 32	15 19	15 07	14 54	14 41	14 26	14 17	14 07
	2	17 55	17 34	17 18	17 05	16 53	16 44	16 27	16 12	15 58	15 45	15 30	15 14	15 04	14 53
	3	18 50	18 29	18 12	17 58	17 47	17 37	17 19	17 04	16 50	16 36	16 21	16 04	15 54	15 42
	4	19 37	19 16	19 00	18 47	18 36	18 26	18 09	17 55	17 41	17 27	17 12	16 56	16 46	16 35
	5	20 15	19 57	19 43	19 31	19 21	19 12	18 56	18 43	18 30	18 18	18 04	17 49	17 40	17 29
	6	20 47	20 32	20 20	20 10	20 01	19 53	19 40	19 29	19 18	19 07	18 55	18 42	18 34	18 25
	7	21 14	21 02	20 53	20 45	20 38	20 32	20 21	20 12	20 03	19 55	19 45	19 35	19 28	19 21
	8	21 38	21 29	21 23	21 17	21 12	21 08	21 00	20 53	20 47	20 41	20 34	20 27	20 22	20 17
	9	21 59	21 54	21 50	21 47	21 44	21 42	21 37	21 34	21 30	21 27	21 23	21 18	21 16	21 13
	10	22 19	22 18	22 17	22 16	22 15	22 15	22 14	22 13	22 12	22 12	22 11	22 10	22 09	22 09
	11	22 39	22 41	22 43	22 45	22 47	22 48	22 50	22 53	22 55	22 57	22 59	23 01	23 03	23 05
	12	22 59	23 06	23 11	23 15	23 19	23 22	23 28	23 33	23 38	23 43	23 48	23 54	23 57	.. ..
	13	23 22	23 32	23 40	23 47	23 53	23 58	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 01
	14	23 49	.. ..	.. ..	.. ..	.. ..	.. ..	0 07	0 15	0 23	0 30	0 38	0 48	0 53	0 59
	15	.. ..	0 03	0 14	0 23	0 31	0 38	0 50	1 00	1 10	1 20	1 31	1 43	1 50	1 59
	16	0 22	0 39	0 52	1 03	1 13	1 21	1 36	1 49	2 01	2 13	2 26	2 40	2 49	2 59
	17	1 02	1 22	1 37	1 50	2 01	2 10	2 26	2 41	2 54	3 08	3 22	3 39	3 49	4 00
	18	1 53	2 13	2 30	2 43	2 55	3 05	3 22	3 37	3 51	4 05	4 20	4 38	4 48	5 00
	19	2 55	3 15	3 31	3 44	3 55	4 05	4 22	4 36	4 50	5 04	5 18	5 35	5 45	5 56
	20	4 07	4 25	4 39	4 51	5 01	5 09	5 24	5 38	5 50	6 02	6 15	6 30	6 39	6 48
	21	5 27	5 41	5 52	6 02	6 10	6 17	6 29	6 39	6 49	6 59	7 09	7 21	7 28	7 36
	22	6 51	7 00	7 08	7 14	7 20	7 24	7 33	7 40	7 47	7 53	8 01	8 09	8 13	8 19
	23	8 15	8 20	8 23	8 26	8 29	8 31	8 35	8 39	8 42	8 46	8 49	8 53	8 56	8 58
	24	9 38	9 38	9 38	9 37	9 37	9 37	9 37	9 37	9 36	9 36	9 36	9 36	9 36	9 36

MOONSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan.	0	0 33	0 46	0 56	1 04	1 12	1 18	1 29	1 39	1 48	1 57	2 07	2 19	2 25	2 32
	1	1 04	1 21	1 34	1 44	1 54	2 02	2 16	2 28	2 40	2 51	3 03	3 18	3 26	3 35
	2	1 41	2 01	2 16	2 28	2 39	2 48	3 04	3 18	3 31	3 45	3 59	4 15	4 24	4 35
	3	2 25	2 46	3 02	3 16	3 27	3 37	3 54	4 09	4 23	4 37	4 52	5 09	5 19	5 31
	4	3 15	3 37	3 53	4 07	4 18	4 28	4 46	5 01	5 15	5 29	5 44	6 01	6 11	6 22
	5	4 12	4 32	4 48	5 01	5 11	5 21	5 37	5 52	6 05	6 18	6 32	6 48	6 58	7 08
	6	5 13	5 31	5 45	5 56	6 06	6 14	6 29	6 41	6 53	7 05	7 18	7 32	7 40	7 50
	7	6 17	6 31	6 43	6 52	7 00	7 07	7 19	7 30	7 40	7 50	8 00	8 12	8 19	8 27
	8	7 22	7 33	7 41	7 48	7 55	8 00	8 09	8 17	8 25	8 32	8 40	8 49	8 54	9 00
	9	8 27	8 34	8 40	8 44	8 48	8 52	8 58	9 03	9 08	9 13	9 18	9 24	9 27	9 31
	10	9 32	9 35	9 38	9 40	9 42	9 43	9 46	9 48	9 50	9 53	9 55	9 57	9 59	10 01
	11	10 38	10 37	10 36	10 36	10 35	10 35	10 34	10 33	10 33	10 32	10 31	10 30	10 30	10 29
	12	11 43	11 39	11 35	11 32	11 29	11 27	11 22	11 19	11 15	11 12	11 08	11 04	11 02	10 59
	13	12 50	12 42	12 35	12 29	12 24	12 20	12 12	12 05	11 59	11 53	11 46	11 39	11 35	11 30
	14	13 58	13 46	13 36	13 27	13 20	13 14	13 03	12 54	12 45	12 36	12 27	12 16	12 10	12 03
	15	15 07	14 51	14 38	14 27	14 18	14 10	13 57	13 45	13 34	13 23	13 11	12 58	12 50	12 41
	16	16 14	15 55	15 40	15 28	15 17	15 08	14 53	14 39	14 26	14 13	13 59	13 44	13 34	13 24
	17	17 18	16 58	16 42	16 28	16 17	16 07	15 50	15 35	15 21	15 07	14 52	14 35	14 25	14 14
	18	18 17	17 56	17 40	17 26	17 15	17 05	16 48	16 33	16 19	16 05	15 50	15 33	15 22	15 11
	19	19 07	18 48	18 33	18 21	18 10	18 01	17 45	17 32	17 18	17 05	16 51	16 35	16 26	16 15
	20	19 49	19 33	19 21	19 11	19 02	18 54	18 41	18 29	18 18	18 07	17 55	17 41	17 33	17 24
	21	20 23	20 12	20 03	19 56	19 49	19 44	19 34	19 25	19 17	19 08	18 59	18 49	18 43	18 36
	22	20 53	20 47	20 42	20 37	20 33	20 30	20 24	20 18	20 13	20 08	20 03	19 56	19 53	19 49
	23	21 20	21 18	21 17	21 15	21 14	21 13	21 11	21 10	21 08	21 07	21 05	21 03	21 02	21 00
	24	21 46	21 48	21 50	21 52	21 54	21 55	21 57	22 00	22 01	22 03	22 05	22 08	22 09	22 11

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2015
UNIVERSAL TIME FOR MERIDIAN OF GREENWICH
MOONRISE

33

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan. 0	13 25	13 22	13 18	13 14	13 09	13 04	12 59	12 53	12 47	12 39	12 31	12 22	12 11	11 58
1	14 07	14 03	13 58	13 53	13 48	13 42	13 35	13 28	13 20	13 11	13 01	12 49	12 35	12 18
2	14 53	14 48	14 43	14 37	14 31	14 24	14 17	14 09	14 00	13 49	13 37	13 23	13 07	12 46
3	15 42	15 37	15 32	15 26	15 19	15 12	15 04	14 56	14 46	14 35	14 23	14 08	13 50	13 27
4	16 35	16 30	16 24	16 18	16 12	16 05	15 58	15 49	15 40	15 29	15 17	15 03	14 45	14 23
5	17 29	17 25	17 20	17 15	17 09	17 03	16 56	16 48	16 40	16 30	16 19	16 06	15 50	15 32
6	18 25	18 21	18 17	18 13	18 08	18 02	17 56	17 50	17 43	17 35	17 25	17 15	17 02	16 47
7	19 21	19 18	19 15	19 11	19 08	19 03	18 59	18 54	18 48	18 42	18 35	18 26	18 17	18 06
8	20 17	20 15	20 13	20 10	20 08	20 05	20 01	19 58	19 54	19 50	19 45	19 39	19 33	19 25
9	21 13	21 12	21 11	21 09	21 08	21 06	21 04	21 02	21 00	20 58	20 55	20 52	20 48	20 44
10	22 09	22 08	22 08	22 08	22 08	22 07	22 07	22 06	22 06	22 06	22 05	22 04	22 04	22 03
11	23 05	23 05	23 06	23 07	23 08	23 09	23 10	23 11	23 12	23 14	23 16	23 17	23 20	23 22
12	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
13	0 01	0 03	0 05	0 07	0 09	0 11	0 14	0 17	0 20	0 23	0 27	0 31	0 37	0 42
14	0 59	1 02	1 05	1 08	1 11	1 15	1 19	1 23	1 28	1 34	1 40	1 47	1 55	2 05
15	1 59	2 02	2 06	2 10	2 15	2 20	2 25	2 31	2 38	2 45	2 54	3 03	3 15	3 29
16	2 59	3 03	3 08	3 13	3 19	3 25	3 31	3 39	3 47	3 56	4 07	4 19	4 34	4 52
17	4 00	4 05	4 10	4 16	4 22	4 29	4 36	4 45	4 54	5 05	5 17	5 32	5 49	6 11
18	5 00	5 05	5 10	5 16	5 23	5 30	5 38	5 46	5 56	6 07	6 20	6 35	6 54	7 17
19	5 56	6 01	6 06	6 12	6 18	6 25	6 33	6 41	6 50	7 01	7 13	7 27	7 44	8 05
20	6 48	6 53	6 57	7 02	7 08	7 14	7 20	7 27	7 35	7 44	7 55	8 07	8 20	8 37
21	7 36	7 39	7 43	7 47	7 51	7 56	8 01	8 06	8 13	8 19	8 27	8 36	8 46	8 58
22	8 19	8 21	8 24	8 26	8 29	8 32	8 36	8 39	8 44	8 48	8 53	8 59	9 06	9 13
23	8 58	8 59	9 01	9 02	9 03	9 05	9 07	9 09	9 11	9 13	9 15	9 18	9 21	9 25
24	9 36	9 36	9 36	9 36	9 35	9 35	9 35	9 35	9 35	9 35	9 35	9 35	9 35	9 35

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan. 0	2 32	2 36	2 39	2 43	2 47	2 52	2 57	3 02	3 08	3 15	3 22	3 31	3 41	3 53
1	3 35	3 39	3 44	3 48	3 54	3 59	4 05	4 12	4 20	4 29	4 39	4 50	5 04	5 20
2	4 35	4 40	4 45	4 50	4 56	5 03	5 10	5 18	5 27	5 37	5 49	6 02	6 19	6 39
3	5 31	5 36	5 41	5 47	5 54	6 01	6 08	6 17	6 26	6 37	6 50	7 05	7 23	7 45
4	6 22	6 27	6 33	6 38	6 45	6 52	6 59	7 08	7 17	7 28	7 41	7 55	8 13	8 35
5	7 08	7 13	7 18	7 24	7 30	7 36	7 43	7 51	8 00	8 10	8 21	8 34	8 50	9 09
6	7 50	7 54	7 58	8 03	8 08	8 14	8 20	8 27	8 34	8 43	8 53	9 04	9 17	9 33
7	8 27	8 30	8 34	8 38	8 42	8 46	8 51	8 57	9 03	9 10	9 18	9 26	9 37	9 49
8	9 00	9 03	9 05	9 08	9 12	9 15	9 19	9 23	9 27	9 32	9 38	9 44	9 52	10 00
9	9 31	9 33	9 35	9 36	9 39	9 41	9 43	9 46	9 49	9 52	9 55	9 59	10 04	10 09
10	10 01	10 01	10 02	10 03	10 04	10 05	10 06	10 07	10 08	10 10	10 11	10 13	10 15	10 17
11	10 29	10 29	10 29	10 29	10 28	10 28	10 28	10 27	10 27	10 27	10 26	10 26	10 25	10 24
12	10 59	10 58	10 56	10 55	10 54	10 52	10 50	10 48	10 46	10 44	10 41	10 39	10 35	10 31
13	11 30	11 28	11 25	11 23	11 20	11 17	11 14	11 11	11 07	11 03	10 58	10 53	10 47	10 40
14	12 03	12 00	11 57	11 53	11 50	11 46	11 41	11 36	11 31	11 25	11 18	11 10	11 01	10 50
15	12 41	12 37	12 33	12 28	12 23	12 18	12 12	12 06	11 59	11 51	11 42	11 32	11 20	11 05
16	13 24	13 19	13 14	13 09	13 03	12 57	12 50	12 43	12 34	12 24	12 13	12 01	11 45	11 27
17	14 14	14 09	14 03	13 57	13 51	13 44	13 37	13 28	13 18	13 08	12 55	12 41	12 23	12 01
18	15 11	15 06	15 00	14 54	14 48	14 41	14 33	14 24	14 14	14 03	13 50	13 35	13 17	12 54
19	16 15	16 10	16 05	15 59	15 53	15 47	15 39	15 31	15 22	15 12	15 00	14 46	14 29	14 09
20	17 24	17 20	17 15	17 11	17 06	17 00	16 54	16 47	16 40	16 31	16 21	16 10	15 57	15 41
21	18 36	18 33	18 30	18 26	18 22	18 18	18 14	18 09	18 03	17 57	17 50	17 42	17 33	17 21
22	19 49	19 47	19 45	19 43	19 40	19 38	19 35	19 32	19 29	19 25	19 21	19 16	19 11	19 04
23	21 00	21 00	20 59	20 58	20 58	20 57	20 56	20 55	20 54	20 53	20 51	20 50	20 48	20 46
24	22 11	22 11	22 12	22 13	22 13	22 14	22 15	22 16	22 17	22 19	22 20	22 22	22 24	22 26

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2015
UNIVERSAL TIME FOR MERIDIAN OF GREENWICH
MOONRISE

Lat.		-55°	-50°	-45°	-40°	-35°	-30°	-20°	-10°	0°	+10°	+20°	+30°	+35°	+40°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan.	23	8 15	8 20	8 23	8 26	8 29	8 31	8 35	8 39	8 42	8 46	8 49	8 53	8 56	8 58
	24	9 38	9 38	9 38	9 37	9 37	9 37	9 37	9 37	9 36	9 36	9 36	9 36	9 36	9 36
	25	10 59	10 54	10 50	10 47	10 44	10 41	10 37	10 33	10 29	10 25	10 22	10 17	10 15	10 12
	26	12 18	12 08	12 00	11 54	11 48	11 43	11 35	11 28	11 21	11 14	11 07	10 59	10 54	10 49
	27	13 33	13 19	13 08	12 59	12 51	12 44	12 32	12 22	12 12	12 03	11 53	11 41	11 35	11 27
	28	14 43	14 26	14 12	14 01	13 51	13 43	13 28	13 16	13 04	12 52	12 40	12 26	12 17	12 08
	29	15 48	15 28	15 12	14 59	14 48	14 39	14 23	14 09	13 55	13 42	13 28	13 12	13 03	12 52
	30	16 45	16 24	16 07	15 54	15 42	15 32	15 15	15 00	14 46	14 32	14 18	14 01	13 51	13 39
	31	17 34	17 13	16 57	16 44	16 32	16 22	16 05	15 51	15 37	15 23	15 08	14 51	14 41	14 30
Feb.	1	18 15	17 56	17 41	17 29	17 18	17 09	16 53	16 39	16 26	16 13	15 59	15 43	15 34	15 23
	2	18 49	18 33	18 20	18 09	18 00	17 52	17 38	17 25	17 14	17 02	16 50	16 36	16 27	16 18
	3	19 18	19 05	18 54	18 45	18 38	18 31	18 19	18 09	18 00	17 50	17 40	17 28	17 21	17 14
	4	19 43	19 33	19 25	19 19	19 13	19 08	18 59	18 51	18 44	18 37	18 29	18 20	18 15	18 10
	5	20 05	19 59	19 54	19 49	19 46	19 43	19 37	19 32	19 28	19 23	19 18	19 12	19 09	19 05
	6	20 25	20 23	20 21	20 19	20 18	20 16	20 14	20 12	20 10	20 08	20 06	20 04	20 02	20 01
	7	20 45	20 46	20 47	20 48	20 49	20 49	20 50	20 51	20 52	20 53	20 54	20 55	20 56	20 57
	8	21 06	21 10	21 14	21 18	21 20	21 23	21 27	21 31	21 35	21 38	21 42	21 47	21 50	21 53
	9	21 28	21 36	21 43	21 48	21 53	21 58	22 05	22 12	22 18	22 25	22 32	22 39	22 44	22 49
	10	21 52	22 04	22 14	22 22	22 29	22 35	22 46	22 55	23 04	23 13	23 22	23 33	23 39	23 47
	11	22 21	22 37	22 49	22 59	23 08	23 15	23 29	23 40	23 51	.. ..	.. ..	.. ..	.. ..	.. ..
	12	22 57	23 15	23 29	23 41	23 51	.. ..	.. ..	.. ..	.. ..	0 03	0 14	0 28	0 36	0 45
	13	23 40	.. ..	.. ..	.. ..	.. ..	0 00	0 16	0 29	0 42	0 55	1 08	1 24	1 33	1 44
	14	.. ..	0 01	0 16	0 29	0 41	0 50	1 07	1 22	1 35	1 49	2 04	2 21	2 31	2 42
	15	0 35	0 55	1 11	1 25	1 36	1 46	2 03	2 18	2 32	2 45	3 00	3 17	3 27	3 39
	16	1 40	1 59	2 14	2 27	2 37	2 47	3 03	3 17	3 30	3 43	3 57	4 13	4 22	4 32

MOONSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan.	23	21 20	21 18	21 17	21 15	21 14	21 13	21 11	21 10	21 08	21 07	21 05	21 03	21 02	21 00
	24	21 46	21 48	21 50	21 52	21 54	21 55	21 57	22 00	22 01	22 03	22 05	22 08	22 09	22 11
	25	22 11	22 18	22 24	22 29	22 33	22 37	22 43	22 48	22 54	22 59	23 05	23 11	23 15	23 19
	26	22 39	22 50	22 59	23 06	23 13	23 19	23 29	23 37	23 45	23 54	.. ..	.. ..	.. ..	.. ..
	27	23 09	23 24	23 36	23 46	23 54	.. ..	.. ..	.. ..	.. ..	.. ..	0 02	0 12	0 18	0 25
	28	23 44	.. ..	.. ..	.. ..	.. ..	0 02	0 15	0 26	0 37	0 48	0 59	1 12	1 20	1 29
	29	.. ..	0 02	0 16	0 28	0 38	0 47	1 03	1 16	1 29	1 41	1 55	2 10	2 19	2 29
	30	0 25	0 45	1 01	1 14	1 25	1 35	1 52	2 06	2 20	2 34	2 48	3 05	3 15	3 26
	31	1 12	1 33	1 50	2 03	2 14	2 25	2 42	2 57	3 11	3 25	3 40	3 57	4 07	4 18
Feb.	1	2 06	2 26	2 42	2 55	3 06	3 16	3 33	3 47	4 01	4 14	4 29	4 45	4 55	5 06
	2	3 04	3 23	3 37	3 49	3 59	4 08	4 23	4 37	4 49	5 02	5 15	5 30	5 38	5 48
	3	4 07	4 22	4 35	4 45	4 53	5 01	5 14	5 25	5 36	5 47	5 58	6 11	6 18	6 27
	4	5 11	5 23	5 33	5 41	5 47	5 54	6 04	6 13	6 21	6 30	6 39	6 49	6 55	7 01
	5	6 16	6 24	6 31	6 37	6 41	6 46	6 53	6 59	7 05	7 11	7 17	7 25	7 29	7 33
	6	7 21	7 25	7 29	7 32	7 35	7 37	7 41	7 45	7 48	7 51	7 55	7 59	8 01	8 03
	7	8 26	8 27	8 27	8 28	8 28	8 29	8 29	8 30	8 30	8 31	8 31	8 32	8 32	8 33
	8	9 31	9 28	9 26	9 24	9 22	9 20	9 17	9 15	9 13	9 10	9 08	9 05	9 03	9 02
	9	10 37	10 30	10 24	10 20	10 16	10 12	10 06	10 01	9 56	9 51	9 45	9 39	9 36	9 32
	10	11 43	11 32	11 24	11 17	11 10	11 05	10 56	10 48	10 40	10 32	10 24	10 15	10 10	10 04
	11	12 50	12 35	12 24	12 14	12 06	11 59	11 47	11 36	11 26	11 16	11 06	10 54	10 47	10 39
	12	13 56	13 38	13 24	13 13	13 03	12 55	12 40	12 27	12 15	12 03	11 51	11 36	11 28	11 18
	13	15 00	14 40	14 24	14 12	14 01	13 51	13 35	13 21	13 07	12 54	12 40	12 23	12 14	12 03
	14	15 59	15 39	15 22	15 09	14 58	14 48	14 31	14 16	14 02	13 48	13 33	13 16	13 06	12 54
	15	16 52	16 33	16 17	16 04	15 53	15 44	15 27	15 13	14 59	14 45	14 31	14 14	14 04	13 53
	16	17 38	17 21	17 07	16 56	16 46	16 38	16 23	16 10	15 58	15 45	15 32	15 17	15 08	14 58

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2015
UNIVERSAL TIME FOR MERIDIAN OF GREENWICH
MOONRISE

35

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan. 23	8 58	8 59	9 01	9 02	9 03	9 05	9 07	9 09	9 11	9 13	9 15	9 18	9 21	9 25
24	9 36	9 36	9 36	9 36	9 35	9 35	9 35	9 35	9 35	9 35	9 35	9 35	9 35	9 35
25	10 12	10 11	10 10	10 08	10 07	10 05	10 03	10 02	10 00	9 57	9 55	9 52	9 49	9 45
26	10 49	10 47	10 44	10 42	10 39	10 36	10 32	10 29	10 25	10 20	10 15	10 10	10 03	9 56
27	11 27	11 24	11 21	11 17	11 13	11 08	11 03	10 58	10 52	10 46	10 39	10 30	10 20	10 09
28	12 08	12 04	12 00	11 55	11 50	11 44	11 38	11 31	11 24	11 16	11 06	10 55	10 42	10 27
29	12 52	12 47	12 42	12 37	12 31	12 25	12 18	12 10	12 01	11 51	11 40	11 27	11 11	10 52
30	13 39	13 34	13 29	13 23	13 17	13 10	13 02	12 54	12 45	12 34	12 22	12 07	11 50	11 28
31	14 30	14 25	14 20	14 14	14 07	14 01	13 53	13 44	13 35	13 24	13 12	12 57	12 40	12 18
Feb. 1	15 23	15 18	15 13	15 08	15 02	14 55	14 48	14 40	14 32	14 22	14 10	13 57	13 40	13 21
2	16 18	16 14	16 09	16 05	15 59	15 54	15 47	15 41	15 33	15 24	15 14	15 03	14 49	14 33
3	17 14	17 10	17 07	17 03	16 58	16 54	16 49	16 43	16 37	16 30	16 22	16 13	16 02	15 50
4	18 10	18 07	18 04	18 01	17 58	17 55	17 51	17 47	17 42	17 37	17 31	17 25	17 17	17 08
5	19 05	19 04	19 02	19 00	18 58	18 56	18 54	18 51	18 48	18 45	18 41	18 37	18 33	18 27
6	20 01	20 00	20 00	19 59	19 58	19 57	19 56	19 55	19 54	19 53	19 51	19 50	19 48	19 46
7	20 57	20 57	20 57	20 58	20 58	20 59	20 59	21 00	21 00	21 01	21 02	21 02	21 03	21 04
8	21 53	21 54	21 55	21 57	21 58	22 00	22 02	22 04	22 07	22 09	22 12	22 15	22 19	22 24
9	22 49	22 51	22 54	22 56	22 59	23 02	23 06	23 09	23 14	23 18	23 23	23 29	23 36	23 44
10	23 47	23 50	23 53	23 57	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
11	.. ..	.. ..	.. ..	.. ..	0 01	0 05	0 10	0 15	0 21	0 28	0 35	0 43	0 53	1 05
12	0 45	0 49	0 53	0 58	1 03	1 08	1 14	1 21	1 28	1 37	1 46	1 57	2 11	2 26
13	1 44	1 48	1 53	1 59	2 05	2 11	2 18	2 26	2 35	2 45	2 56	3 09	3 25	3 45
14	2 42	2 47	2 53	2 58	3 05	3 12	3 19	3 28	3 37	3 48	4 01	4 16	4 33	4 56
15	3 39	3 44	3 49	3 55	4 02	4 08	4 16	4 25	4 34	4 45	4 58	5 12	5 30	5 52
16	4 32	4 37	4 42	4 48	4 53	5 00	5 07	5 15	5 23	5 33	5 44	5 57	6 13	6 32

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan. 23	21 00	21 00	20 59	20 58	20 58	20 57	20 56	20 55	20 54	20 53	20 51	20 50	20 48	20 46
24	22 11	22 11	22 12	22 13	22 13	22 14	22 15	22 16	22 17	22 19	22 20	22 22	22 24	22 26
25	23 19	23 21	23 23	23 25	23 27	23 29	23 32	23 35	23 38	23 42	23 46	23 51	23 56	.. ..
26	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 02
27	0 25	0 28	0 31	0 34	0 38	0 42	0 46	0 51	0 56	1 02	1 09	1 16	1 25	1 36
28	1 29	1 32	1 37	1 41	1 46	1 51	1 57	2 03	2 10	2 18	2 27	2 37	2 50	3 04
29	2 29	2 34	2 38	2 44	2 49	2 56	3 02	3 10	3 18	3 28	3 39	3 52	4 07	4 26
30	3 26	3 31	3 36	3 42	3 48	3 55	4 02	4 11	4 20	4 31	4 43	4 57	5 14	5 36
31	4 18	4 23	4 29	4 34	4 41	4 48	4 55	5 04	5 13	5 24	5 37	5 51	6 09	6 31
Feb. 1	5 06	5 10	5 16	5 21	5 27	5 34	5 41	5 49	5 58	6 08	6 20	6 34	6 50	7 11
2	5 48	5 53	5 57	6 02	6 08	6 14	6 20	6 27	6 35	6 44	6 55	7 07	7 21	7 38
3	6 27	6 30	6 34	6 38	6 43	6 48	6 54	7 00	7 06	7 14	7 22	7 32	7 43	7 56
4	7 01	7 04	7 07	7 11	7 14	7 18	7 22	7 27	7 32	7 38	7 44	7 52	8 00	8 10
5	7 33	7 35	7 37	7 40	7 42	7 45	7 48	7 51	7 55	7 58	8 03	8 08	8 13	8 20
6	8 03	8 05	8 06	8 07	8 08	8 10	8 11	8 13	8 15	8 17	8 19	8 22	8 25	8 28
7	8 33	8 33	8 33	8 33	8 33	8 33	8 34	8 34	8 34	8 34	8 35	8 35	8 36	8 36
8	9 02	9 01	9 00	8 59	8 58	8 57	8 56	8 55	8 53	8 52	8 50	8 48	8 46	8 43
9	9 32	9 30	9 28	9 26	9 24	9 22	9 19	9 16	9 13	9 10	9 06	9 02	8 57	8 52
10	10 04	10 01	9 58	9 55	9 52	9 48	9 44	9 40	9 36	9 30	9 24	9 18	9 10	9 01
11	10 39	10 35	10 31	10 27	10 23	10 18	10 13	10 07	10 01	9 54	9 46	9 37	9 26	9 14
12	11 18	11 14	11 09	11 04	10 59	10 53	10 47	10 40	10 32	10 23	10 13	10 02	9 48	9 32
13	12 03	11 58	11 53	11 47	11 41	11 35	11 27	11 19	11 10	11 00	10 49	10 35	10 19	9 59
14	12 54	12 49	12 44	12 38	12 32	12 25	12 17	12 08	11 59	11 48	11 35	11 20	11 02	10 40
15	13 53	13 48	13 43	13 37	13 31	13 24	13 16	13 08	12 58	12 48	12 35	12 21	12 03	11 41
16	14 58	14 54	14 49	14 44	14 38	14 32	14 25	14 18	14 09	14 00	13 49	13 36	13 21	13 03

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2015
UNIVERSAL TIME FOR MERIDIAN OF GREENWICH
MOONRISE

Lat.	-55°	-50°	-45°	-40°	-35°	-30°	-20°	-10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Feb. 15	0 35	0 55	1 11	1 25	1 36	1 46	2 03	2 18	2 32	2 45	3 00	3 17	3 27	3 39
16	1 40	1 59	2 14	2 27	2 37	2 47	3 03	3 17	3 30	3 43	3 57	4 13	4 22	4 32
17	2 55	3 11	3 24	3 35	3 44	3 52	4 05	4 17	4 29	4 40	4 52	5 05	5 13	5 22
18	4 17	4 29	4 38	4 46	4 53	4 59	5 10	5 19	5 27	5 36	5 45	5 55	6 01	6 08
19	5 42	5 49	5 55	6 00	6 04	6 08	6 14	6 20	6 25	6 30	6 36	6 42	6 46	6 50
20	7 08	7 11	7 12	7 14	7 15	7 16	7 18	7 20	7 22	7 23	7 25	7 27	7 28	7 30
21	8 33	8 31	8 28	8 26	8 25	8 23	8 21	8 19	8 17	8 15	8 13	8 11	8 09	8 08
22	9 56	9 49	9 42	9 37	9 33	9 29	9 22	9 17	9 11	9 06	9 00	8 54	8 50	8 46
23	11 16	11 03	10 54	10 46	10 39	10 33	10 23	10 14	10 05	9 57	9 48	9 38	9 32	9 26
24	12 30	12 14	12 01	11 51	11 42	11 34	11 21	11 09	10 58	10 47	10 36	10 23	10 15	10 07
25	13 38	13 19	13 05	12 52	12 42	12 33	12 17	12 04	11 51	11 38	11 25	11 10	11 01	10 51
26	14 39	14 18	14 02	13 49	13 38	13 28	13 11	12 57	12 43	12 29	12 15	11 58	11 48	11 37
27	15 31	15 10	14 54	14 41	14 29	14 19	14 02	13 48	13 34	13 20	13 05	12 48	12 38	12 27
28	16 14	15 55	15 40	15 27	15 16	15 07	14 51	14 37	14 23	14 10	13 56	13 40	13 30	13 19
Mar. 1	16 51	16 34	16 20	16 09	15 59	15 51	15 36	15 23	15 11	14 59	14 46	14 32	14 23	14 13
2	17 21	17 07	16 56	16 46	16 38	16 31	16 18	16 08	15 57	15 47	15 36	15 24	15 17	15 08
3	17 47	17 36	17 28	17 20	17 14	17 08	16 59	16 50	16 42	16 34	16 26	16 16	16 10	16 04
4	18 10	18 03	17 57	17 52	17 48	17 44	17 37	17 31	17 26	17 20	17 14	17 08	17 04	16 59
5	18 31	18 28	18 25	18 22	18 20	18 18	18 14	18 11	18 08	18 06	18 03	17 59	17 57	17 55
6	18 52	18 52	18 51	18 51	18 51	18 51	18 51	18 51	18 51	18 51	18 51	18 51	18 51	18 51
7	19 12	19 16	19 18	19 21	19 23	19 25	19 28	19 31	19 33	19 36	19 39	19 42	19 44	19 47
8	19 34	19 41	19 46	19 51	19 55	19 59	20 06	20 11	20 17	20 22	20 28	20 35	20 39	20 43
9	19 57	20 08	20 16	20 24	20 30	20 35	20 45	20 53	21 01	21 09	21 18	21 28	21 33	21 40
10	20 24	20 38	20 50	20 59	21 07	21 14	21 27	21 37	21 48	21 58	22 09	22 22	22 29	22 37
11	20 57	21 14	21 27	21 39	21 48	21 57	22 11	22 24	22 36	22 48	23 01	23 16	23 25	23 35

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Feb. 15	16 52	16 33	16 17	16 04	15 53	15 44	15 27	15 13	14 59	14 45	14 31	14 14	14 04	13 53
16	17 38	17 21	17 07	16 56	16 46	16 38	16 23	16 10	15 58	15 45	15 32	15 17	15 08	14 58
17	18 17	18 03	17 52	17 43	17 36	17 29	17 17	17 06	16 56	16 47	16 36	16 24	16 16	16 08
18	18 50	18 41	18 33	18 27	18 22	18 17	18 09	18 02	17 55	17 48	17 40	17 32	17 27	17 21
19	19 19	19 15	19 11	19 08	19 06	19 03	18 59	18 55	18 52	18 48	18 45	18 40	18 38	18 35
20	19 46	19 47	19 47	19 47	19 47	19 47	19 48	19 48	19 48	19 48	19 48	19 48	19 48	19 48
21	20 13	20 18	20 22	20 25	20 28	20 31	20 35	20 39	20 43	20 47	20 50	20 55	20 57	21 00
22	20 41	20 50	20 58	21 04	21 10	21 14	21 23	21 30	21 37	21 44	21 51	22 00	22 05	22 10
23	21 11	21 25	21 35	21 44	21 52	21 59	22 11	22 21	22 31	22 40	22 51	23 02	23 09	23 17
24	21 45	22 02	22 16	22 27	22 36	22 45	22 59	23 12	23 24	23 35	23 48	.. ..	.. ..	.. ..
25	22 25	22 44	23 00	23 12	23 23	23 32	23 49	.. ..	.. ..	.. ..	.. ..	0 03	0 11	0 21
26	23 10	23 31	23 47	.. ..	.. ..	.. ..	.. ..	0 03	0 16	0 29	0 43	1 00	1 09	1 20
27	.. ..	.. ..	.. ..	0 01	0 12	0 22	0 39	0 54	1 08	1 21	1 36	1 53	2 03	2 14
28	0 02	0 23	0 39	0 52	1 03	1 13	1 30	1 44	1 58	2 11	2 26	2 43	2 52	3 03
Mar. 1	0 59	1 18	1 33	1 45	1 55	2 05	2 20	2 34	2 47	2 59	3 13	3 28	3 37	3 47
2	2 00	2 16	2 29	2 40	2 49	2 57	3 11	3 23	3 34	3 45	3 57	4 10	4 18	4 27
3	3 03	3 16	3 26	3 35	3 42	3 49	4 00	4 10	4 19	4 28	4 38	4 49	4 55	5 03
4	4 07	4 16	4 24	4 31	4 36	4 41	4 49	4 57	5 03	5 10	5 17	5 25	5 30	5 35
5	5 12	5 17	5 22	5 26	5 30	5 33	5 38	5 42	5 46	5 51	5 55	6 00	6 03	6 06
6	6 17	6 19	6 20	6 22	6 23	6 24	6 26	6 27	6 29	6 30	6 32	6 34	6 35	6 36
7	7 22	7 20	7 19	7 18	7 17	7 16	7 14	7 13	7 11	7 10	7 09	7 07	7 06	7 05
8	8 27	8 22	8 17	8 14	8 10	8 08	8 03	7 58	7 54	7 50	7 46	7 41	7 38	7 35
9	9 33	9 24	9 16	9 10	9 05	9 00	8 52	8 45	8 38	8 31	8 24	8 16	8 11	8 06
10	10 39	10 26	10 16	10 07	10 00	9 53	9 42	9 33	9 23	9 14	9 05	8 53	8 47	8 40
11	11 45	11 28	11 15	11 05	10 56	10 48	10 34	10 22	10 11	10 00	9 48	9 34	9 26	9 17

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2015

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

37

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Feb. 15	3 39	3 44	3 49	3 55	4 02	4 08	4 16	4 25	4 34	4 45	4 58	5 12	5 30	5 52
16	4 32	4 37	4 42	4 48	4 53	5 00	5 07	5 15	5 23	5 33	5 44	5 57	6 13	6 32
17	5 22	5 26	5 30	5 35	5 40	5 45	5 51	5 57	6 05	6 13	6 22	6 32	6 44	6 59
18	6 08	6 11	6 14	6 17	6 21	6 25	6 29	6 34	6 39	6 45	6 52	6 59	7 08	7 18
19	6 50	6 52	6 54	6 56	6 58	7 00	7 03	7 06	7 09	7 13	7 16	7 21	7 26	7 32
20	7 30	7 30	7 31	7 32	7 32	7 33	7 34	7 35	7 36	7 37	7 38	7 40	7 41	7 43
21	8 08	8 07	8 07	8 06	8 05	8 04	8 04	8 03	8 02	8 00	7 59	7 58	7 56	7 54
22	8 46	8 44	8 43	8 41	8 38	8 36	8 33	8 31	8 27	8 24	8 20	8 16	8 11	8 05
23	9 26	9 23	9 20	9 16	9 13	9 09	9 05	9 00	8 55	8 50	8 43	8 36	8 28	8 18
24	10 07	10 03	9 59	9 55	9 50	9 45	9 39	9 33	9 26	9 19	9 10	9 00	8 49	8 35
25	10 51	10 46	10 41	10 36	10 31	10 25	10 18	10 11	10 02	9 53	9 42	9 30	9 16	8 58
26	11 37	11 33	11 27	11 22	11 16	11 09	11 02	10 53	10 44	10 34	10 22	10 08	9 51	9 31
27	12 27	12 22	12 17	12 11	12 05	11 58	11 50	11 42	11 33	11 22	11 10	10 55	10 38	10 16
28	13 19	13 15	13 09	13 04	12 58	12 51	12 44	12 36	12 27	12 17	12 05	11 51	11 35	11 14
Mar. 1	14 13	14 09	14 04	13 59	13 54	13 48	13 42	13 34	13 26	13 17	13 07	12 55	12 40	12 23
2	15 08	15 05	15 01	14 57	14 52	14 47	14 42	14 36	14 29	14 21	14 13	14 03	13 51	13 38
3	16 04	16 01	15 58	15 55	15 51	15 47	15 43	15 38	15 33	15 28	15 21	15 14	15 05	14 55
4	16 59	16 57	16 55	16 53	16 51	16 48	16 45	16 42	16 39	16 35	16 31	16 26	16 20	16 13
5	17 55	17 54	17 53	17 52	17 51	17 49	17 48	17 46	17 44	17 43	17 40	17 38	17 35	17 32
6	18 51	18 51	18 51	18 51	18 51	18 51	18 51	18 51	18 51	18 51	18 51	18 50	18 50	18 50
7	19 47	19 48	19 49	19 50	19 51	19 52	19 54	19 55	19 57	19 59	20 01	20 03	20 06	20 09
8	20 43	20 45	20 47	20 49	20 52	20 54	20 57	21 00	21 04	21 07	21 12	21 17	21 22	21 29
9	21 40	21 43	21 46	21 49	21 53	21 57	22 01	22 05	22 11	22 16	22 23	22 30	22 39	22 49
10	22 37	22 41	22 45	22 49	22 54	22 59	23 04	23 11	23 17	23 25	23 34	23 44	23 56	.. ..
11	23 35	23 39	23 44	23 49	23 55	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 10

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Feb. 15	13 53	13 48	13 43	13 37	13 31	13 24	13 16	13 08	12 58	12 48	12 35	12 21	12 03	11 41
16	14 58	14 54	14 49	14 44	14 38	14 32	14 25	14 18	14 09	14 00	13 49	13 36	13 21	13 03
17	16 08	16 05	16 01	15 57	15 52	15 47	15 42	15 36	15 29	15 22	15 13	15 03	14 52	14 38
18	17 21	17 19	17 16	17 13	17 10	17 07	17 03	16 59	16 54	16 49	16 43	16 37	16 29	16 20
19	18 35	18 34	18 32	18 31	18 29	18 28	18 26	18 24	18 21	18 19	18 16	18 13	18 09	18 05
20	19 48	19 48	19 48	19 48	19 48	19 49	19 49	19 49	19 49	19 49	19 49	19 49	19 49	19 49
21	21 00	21 02	21 03	21 04	21 06	21 08	21 10	21 12	21 14	21 16	21 19	21 22	21 26	21 30
22	22 10	22 13	22 15	22 18	22 21	22 24	22 28	22 32	22 36	22 41	22 47	22 53	23 00	23 09
23	23 17	23 21	23 24	23 28	23 33	23 37	23 43	23 48	23 54	.. ..	.. ..	.. ..	.. ..	.. ..
24	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 02	0 10	0 19	0 30	0 43
25	0 21	0 25	0 30	0 34	0 40	0 46	0 52	0 59	1 07	1 16	1 26	1 38	1 52	2 09
26	1 20	1 25	1 30	1 35	1 41	1 48	1 55	2 03	2 12	2 22	2 34	2 48	3 04	3 25
27	2 14	2 19	2 25	2 30	2 37	2 43	2 51	2 59	3 09	3 19	3 32	3 46	4 04	4 25
28	3 03	3 08	3 13	3 19	3 25	3 32	3 39	3 47	3 57	4 07	4 19	4 33	4 49	5 10
Mar. 1	3 47	3 52	3 57	4 02	4 07	4 14	4 20	4 28	4 36	4 45	4 56	5 09	5 23	5 41
2	4 27	4 31	4 35	4 39	4 44	4 50	4 55	5 02	5 09	5 17	5 26	5 36	5 48	6 03
3	5 03	5 06	5 09	5 13	5 17	5 21	5 26	5 31	5 36	5 42	5 50	5 58	6 07	6 18
4	5 35	5 38	5 40	5 43	5 46	5 49	5 52	5 56	6 00	6 04	6 09	6 15	6 22	6 29
5	6 06	6 08	6 09	6 11	6 12	6 14	6 16	6 19	6 21	6 24	6 27	6 30	6 34	6 39
6	6 36	6 36	6 37	6 37	6 38	6 38	6 39	6 40	6 41	6 42	6 43	6 44	6 45	6 47
7	7 05	7 05	7 04	7 03	7 03	7 02	7 02	7 01	7 00	6 59	6 58	6 57	6 56	6 54
8	7 35	7 33	7 32	7 30	7 29	7 27	7 25	7 22	7 20	7 17	7 14	7 11	7 07	7 02
9	8 06	8 04	8 01	7 59	7 56	7 53	7 49	7 46	7 41	7 37	7 32	7 26	7 19	7 12
10	8 40	8 37	8 33	8 30	8 26	8 21	8 17	8 11	8 06	7 59	7 52	7 44	7 35	7 24
11	9 17	9 13	9 09	9 04	8 59	8 54	8 48	8 42	8 34	8 26	8 17	8 07	7 54	7 39

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2015
UNIVERSAL TIME FOR MERIDIAN OF GREENWICH
MOONRISE

Lat.		-55°	-50°	-45°	-40°	-35°	-30°	-20°	-10°	0°	+10°	+20°	+30°	+35°	+40°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Mar.	9	19 57	20 08	20 16	20 24	20 30	20 35	20 45	20 53	21 01	21 09	21 18	21 28	21 33	21 40
	10	20 24	20 38	20 50	20 59	21 07	21 14	21 27	21 37	21 48	21 58	22 09	22 22	22 29	22 37
	11	20 57	21 14	21 27	21 39	21 48	21 57	22 11	22 24	22 36	22 48	23 01	23 16	23 25	23 35
	12	21 36	21 56	22 11	22 23	22 34	22 43	23 00	23 14	23 27	23 41	23 55	.. ..	.. ..	.. ..
	13	22 24	22 45	23 01	23 14	23 25	23 35	23 52	.. ..	.. ..	.. ..	.. ..	0 11	0 21	0 32
	14	23 23	23 42	23 58	.. ..	.. ..	.. ..	.. ..	0 07	0 20	0 34	0 49	1 06	1 16	1 27
	15	.. ..	.. ..	.. ..	0 11	0 22	0 31	0 48	1 02	1 16	1 29	1 43	2 00	2 09	2 20
	16	0 30	0 48	1 02	1 14	1 23	1 32	1 47	2 00	2 12	2 24	2 37	2 52	3 00	3 10
	17	1 46	2 01	2 12	2 21	2 29	2 36	2 48	2 59	3 09	3 19	3 29	3 41	3 48	3 56
	18	3 08	3 18	3 26	3 32	3 38	3 43	3 51	3 59	4 06	4 13	4 20	4 29	4 34	4 39
	19	4 33	4 38	4 42	4 45	4 48	4 51	4 55	4 59	5 02	5 06	5 10	5 14	5 17	5 20
	20	5 59	5 59	5 59	5 59	5 59	5 59	5 59	5 59	5 59	5 59	5 59	5 59	5 59	5 59
	21	7 24	7 19	7 15	7 12	7 09	7 06	7 02	6 58	6 54	6 51	6 47	6 43	6 41	6 38
	22	8 48	8 38	8 30	8 23	8 18	8 13	8 04	7 57	7 50	7 43	7 36	7 28	7 23	7 18
	23	10 08	9 53	9 42	9 33	9 25	9 18	9 06	8 55	8 46	8 36	8 26	8 14	8 07	8 00
	24	11 21	11 04	10 50	10 38	10 29	10 20	10 05	9 52	9 41	9 29	9 16	9 02	8 53	8 44
	25	12 27	12 08	11 52	11 39	11 28	11 19	11 02	10 48	10 35	10 21	10 07	9 51	9 42	9 31
	26	13 24	13 04	12 47	12 34	12 23	12 13	11 56	11 41	11 27	11 14	10 59	10 42	10 32	10 21
	27	14 12	13 52	13 36	13 24	13 13	13 03	12 46	12 32	12 19	12 05	11 51	11 34	11 25	11 14
	28	14 51	14 33	14 19	14 07	13 57	13 48	13 33	13 20	13 08	12 55	12 42	12 27	12 18	12 08
	29	15 24	15 09	14 56	14 46	14 38	14 30	14 17	14 05	13 55	13 44	13 32	13 19	13 11	13 03
	30	15 51	15 39	15 30	15 22	15 15	15 09	14 58	14 49	14 40	14 31	14 22	14 11	14 05	13 58
	31	16 15	16 07	16 00	15 54	15 49	15 44	15 37	15 30	15 24	15 17	15 11	15 03	14 58	14 53
Apr.	1	16 37	16 32	16 28	16 24	16 21	16 19	16 14	16 10	16 07	16 03	15 59	15 54	15 52	15 49
	2	16 57	16 56	16 55	16 54	16 53	16 52	16 51	16 50	16 49	16 48	16 47	16 46	16 45	16 44

MOONSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Mar.	9	9 33	9 24	9 16	9 10	9 05	9 00	8 52	8 45	8 38	8 31	8 24	8 16	8 11	8 06
	10	10 39	10 26	10 16	10 07	10 00	9 53	9 42	9 33	9 23	9 14	9 05	8 53	8 47	8 40
	11	11 45	11 28	11 15	11 05	10 56	10 48	10 34	10 22	10 11	10 00	9 48	9 34	9 26	9 17
	12	12 48	12 29	12 14	12 02	11 52	11 43	11 27	11 13	11 00	10 48	10 34	10 18	10 09	9 59
	13	13 48	13 27	13 11	12 58	12 47	12 38	12 21	12 06	11 52	11 39	11 24	11 07	10 58	10 46
	14	14 42	14 21	14 06	13 53	13 41	13 32	13 15	13 00	12 47	12 33	12 18	12 01	11 51	11 40
	15	15 29	15 11	14 56	14 44	14 34	14 25	14 09	13 55	13 42	13 29	13 16	13 00	12 50	12 40
	16	16 10	15 54	15 42	15 32	15 23	15 15	15 02	14 50	14 39	14 28	14 16	14 02	13 54	13 45
	17	16 44	16 33	16 24	16 16	16 10	16 04	15 53	15 44	15 36	15 27	15 18	15 08	15 02	14 55
	18	17 15	17 08	17 03	16 58	16 54	16 50	16 44	16 38	16 33	16 27	16 22	16 15	16 11	16 07
	19	17 43	17 41	17 39	17 38	17 36	17 35	17 33	17 31	17 29	17 27	17 25	17 23	17 22	17 20
	20	18 11	18 13	18 15	18 17	18 18	18 19	18 21	18 23	18 25	18 27	18 29	18 31	18 32	18 33
	21	18 38	18 45	18 51	18 56	19 00	19 04	19 10	19 16	19 21	19 26	19 32	19 38	19 42	19 46
	22	19 08	19 20	19 29	19 37	19 43	19 49	19 59	20 08	20 17	20 25	20 34	20 44	20 50	20 57
	23	19 42	19 57	20 09	20 20	20 28	20 36	20 49	21 01	21 12	21 23	21 34	21 48	21 55	22 04
	24	20 21	20 39	20 54	21 06	21 16	21 25	21 40	21 54	22 07	22 19	22 33	22 48	22 57	23 08
	25	21 05	21 25	21 41	21 54	22 05	22 15	22 32	22 47	23 00	23 14	23 28	23 45	23 55	.. ..
	26	21 56	22 16	22 33	22 46	22 57	23 07	23 24	23 39	23 52	.. ..	.. ..	.. ..	.. ..	0 06
	27	22 52	23 11	23 27	23 39	23 50	23 59	.. ..	.. ..	.. ..	0 06	0 21	0 37	0 47	0 58
	28	23 52	.. ..	.. ..	.. ..	.. ..	.. ..	0 15	0 29	0 42	0 55	1 09	1 25	1 34	1 45
	29	.. ..	0 09	0 23	0 34	0 44	0 52	1 06	1 19	1 31	1 42	1 55	2 09	2 17	2 26
	30	0 54	1 09	1 20	1 29	1 37	1 44	1 56	2 07	2 17	2 27	2 37	2 49	2 56	3 03
	31	1 58	2 09	2 18	2 25	2 31	2 36	2 46	2 54	3 01	3 09	3 17	3 26	3 31	3 37
Apr.	1	3 02	3 10	3 15	3 20	3 24	3 28	3 34	3 39	3 45	3 50	3 55	4 01	4 04	4 08
	2	4 07	4 11	4 13	4 16	4 18	4 19	4 22	4 25	4 27	4 30	4 32	4 35	4 36	4 38

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2015
UNIVERSAL TIME FOR MERIDIAN OF GREENWICH
MOONRISE

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Lat.		+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Mar.	9	21 40	21 43	21 46	21 49	21 53	21 57	22 01	22 05	22 11	22 16	22 23	22 30	22 39	22 49
	10	22 37	22 41	22 45	22 49	22 54	22 59	23 04	23 11	23 17	23 25	23 34	23 44	23 56	.. ..
	11	23 35	23 39	23 44	23 49	23 55	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 10
	12	.. ..	.. ..	.. ..	.. ..	.. ..	0 01	0 07	0 15	0 23	0 32	0 43	0 55	1 10	1 28
	13	0 32	0 37	0 42	0 48	0 54	1 00	1 08	1 16	1 25	1 36	1 48	2 02	2 19	2 40
	14	1 27	1 32	1 38	1 44	1 50	1 57	2 05	2 13	2 23	2 33	2 46	3 01	3 18	3 40
	15	2 20	2 25	2 30	2 36	2 42	2 49	2 56	3 04	3 13	3 24	3 35	3 49	4 06	4 26
	16	3 10	3 14	3 19	3 24	3 29	3 35	3 42	3 49	3 57	4 05	4 16	4 27	4 41	4 58
	17	3 56	4 00	4 03	4 07	4 12	4 16	4 21	4 27	4 33	4 40	4 48	4 57	5 08	5 20
	18	4 39	4 42	4 44	4 47	4 50	4 53	4 57	5 01	5 05	5 10	5 15	5 21	5 28	5 36
	19	5 20	5 21	5 22	5 24	5 25	5 27	5 29	5 31	5 33	5 35	5 38	5 41	5 45	5 49
	20	5 59	5 59	5 59	5 59	5 59	5 59	5 59	5 59	5 59	6 00	6 00	6 00	6 00	6 00
	21	6 38	6 37	6 36	6 34	6 33	6 31	6 30	6 28	6 26	6 23	6 21	6 18	6 15	6 11
	22	7 18	7 16	7 13	7 10	7 08	7 04	7 01	6 57	6 53	6 49	6 44	6 38	6 32	6 24
	23	8 00	7 56	7 53	7 49	7 45	7 40	7 35	7 30	7 24	7 17	7 10	7 01	6 51	6 40
	24	8 44	8 40	8 35	8 30	8 25	8 20	8 13	8 07	7 59	7 50	7 41	7 30	7 16	7 01
	25	9 31	9 26	9 21	9 16	9 10	9 03	8 56	8 49	8 40	8 30	8 18	8 05	7 49	7 30
	26	10 21	10 16	10 11	10 05	9 59	9 52	9 45	9 36	9 27	9 16	9 04	8 50	8 33	8 12
	27	11 14	11 09	11 04	10 58	10 52	10 45	10 38	10 30	10 20	10 10	9 58	9 44	9 27	9 06
	28	12 08	12 03	11 58	11 53	11 48	11 41	11 35	11 27	11 19	11 09	10 59	10 46	10 31	10 13
	29	13 03	12 59	12 55	12 50	12 45	12 40	12 34	12 28	12 21	12 13	12 04	11 53	11 41	11 26
	30	13 58	13 55	13 52	13 48	13 44	13 40	13 35	13 30	13 25	13 18	13 11	13 03	12 53	12 42
	31	14 53	14 51	14 49	14 46	14 43	14 40	14 37	14 34	14 30	14 25	14 20	14 14	14 08	14 00
Apr.	1	15 49	15 48	15 46	15 45	15 43	15 41	15 39	15 37	15 35	15 32	15 30	15 26	15 23	15 18
	2	16 44	16 44	16 44	16 43	16 43	16 42	16 42	16 41	16 41	16 40	16 39	16 39	16 38	16 37

MOONSET

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Mar.	9	8 06	8 04	8 01	7 59	7 56	7 53	7 49	7 46	7 41	7 37	7 32	7 26	7 19	7 12
	10	8 40	8 37	8 33	8 30	8 26	8 21	8 17	8 11	8 06	7 59	7 52	7 44	7 35	7 24
	11	9 17	9 13	9 09	9 04	8 59	8 54	8 48	8 42	8 34	8 26	8 17	8 07	7 54	7 39
	12	9 59	9 54	9 49	9 44	9 38	9 32	9 25	9 18	9 09	9 00	8 49	8 36	8 21	8 02
	13	10 46	10 41	10 36	10 30	10 24	10 17	10 10	10 01	9 52	9 42	9 29	9 15	8 58	8 37
	14	11 40	11 35	11 30	11 24	11 17	11 11	11 03	10 54	10 45	10 34	10 22	10 07	9 49	9 27
	15	12 40	12 35	12 30	12 25	12 19	12 12	12 05	11 57	11 48	11 38	11 27	11 13	10 57	10 37
	16	13 45	13 41	13 37	13 32	13 27	13 21	13 15	13 09	13 01	12 53	12 43	12 32	12 19	12 03
	17	14 55	14 51	14 48	14 45	14 41	14 36	14 32	14 27	14 21	14 15	14 08	14 00	13 50	13 39
	18	16 07	16 05	16 03	16 00	15 58	15 55	15 52	15 49	15 46	15 42	15 38	15 33	15 27	15 20
	19	17 20	17 19	17 19	17 18	17 17	17 16	17 15	17 14	17 13	17 11	17 10	17 08	17 06	17 04
	20	18 33	18 34	18 35	18 35	18 36	18 37	18 38	18 39	18 40	18 41	18 42	18 44	18 45	18 47
	21	19 46	19 48	19 50	19 52	19 54	19 57	19 59	20 02	20 06	20 09	20 13	20 18	20 23	20 30
	22	20 57	21 00	21 03	21 06	21 10	21 14	21 18	21 23	21 29	21 35	21 41	21 49	21 58	22 09
	23	22 04	22 08	22 12	22 17	22 22	22 27	22 33	22 39	22 47	22 55	23 04	23 15	23 27	23 42
	24	23 08	23 12	23 17	23 23	23 28	23 35	23 41	23 49	23 58	.. ..	.. ..	.. ..	.. ..	.. ..
	25	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 07	0 18	0 31	0 47	1 06
	26	0 06	0 11	0 16	0 22	0 28	0 35	0 42	0 50	1 00	1 10	1 22	1 37	1 54	2 15
	27	0 58	1 03	1 08	1 14	1 20	1 27	1 35	1 43	1 52	2 03	2 15	2 29	2 46	3 07
	28	1 45	1 49	1 54	2 00	2 06	2 12	2 19	2 27	2 35	2 45	2 56	3 09	3 24	3 43
Apr.	29	2 26	2 30	2 35	2 39	2 45	2 50	2 56	3 03	3 10	3 19	3 28	3 39	3 52	4 08
	30	3 03	3 07	3 10	3 14	3 19	3 23	3 28	3 34	3 40	3 46	3 54	4 03	4 13	4 25
	31	3 37	3 40	3 42	3 45	3 49	3 52	3 56	4 00	4 04	4 10	4 15	4 22	4 29	4 38
	1	4 08	4 10	4 12	4 14	4 16	4 18	4 21	4 23	4 26	4 30	4 33	4 38	4 42	4 48
	2	4 38	4 39	4 40	4 41	4 42	4 43	4 44	4 45	4 47	4 48	4 50	4 52	4 54	4 56

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2015
UNIVERSAL TIME FOR MERIDIAN OF GREENWICH
MOONRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr. 1	16 37	16 32	16 28	16 24	16 21	16 19	16 14	16 10	16 07	16 03	15 59	15 54	15 52	15 49
2	16 57	16 56	16 55	16 54	16 53	16 52	16 51	16 50	16 49	16 48	16 47	16 46	16 45	16 44
3	17 18	17 20	17 22	17 23	17 25	17 26	17 28	17 30	17 32	17 33	17 35	17 38	17 39	17 40
4	17 39	17 45	17 50	17 54	17 57	18 00	18 06	18 10	18 15	18 19	18 24	18 30	18 33	18 37
5	18 02	18 11	18 19	18 26	18 31	18 36	18 45	18 52	18 59	19 07	19 14	19 23	19 28	19 34
6	18 28	18 41	18 52	19 00	19 08	19 14	19 26	19 36	19 46	19 55	20 05	20 17	20 24	20 32
7	18 59	19 15	19 28	19 39	19 48	19 56	20 10	20 22	20 34	20 45	20 58	21 12	21 20	21 30
8	19 36	19 55	20 09	20 22	20 32	20 41	20 57	21 11	21 24	21 37	21 51	22 07	22 16	22 27
9	20 21	20 41	20 57	21 10	21 21	21 31	21 47	22 02	22 16	22 30	22 44	23 01	23 11	23 22
10	21 14	21 35	21 50	22 03	22 15	22 24	22 41	22 56	23 09	23 23	23 38	23 54	.. ..	.. ..
11	22 17	22 36	22 51	23 03	23 13	23 22	23 37	23 51	.. ..	.. ..	.. ..	.. ..	0 04	0 15
12	23 28	23 44	23 56	.. ..	.. ..	.. ..	.. ..	.. ..	0 04	0 16	0 30	0 45	0 54	1 05
13	.. ..	.. ..	.. ..	0 06	0 15	0 23	0 36	0 48	0 58	1 09	1 21	1 34	1 42	1 50
14	0 44	0 56	1 06	1 13	1 20	1 26	1 36	1 45	1 53	2 02	2 10	2 21	2 26	2 33
15	2 05	2 12	2 18	2 23	2 27	2 31	2 37	2 43	2 48	2 53	2 59	3 05	3 09	3 13
16	3 28	3 30	3 32	3 34	3 35	3 37	3 39	3 41	3 43	3 44	3 46	3 49	3 50	3 51
17	4 52	4 49	4 47	4 46	4 44	4 43	4 41	4 39	4 37	4 36	4 34	4 32	4 31	4 29
18	6 16	6 08	6 03	5 58	5 53	5 50	5 43	5 38	5 32	5 27	5 22	5 16	5 12	5 08
19	7 38	7 26	7 17	7 09	7 02	6 56	6 46	6 37	6 28	6 20	6 11	6 01	5 56	5 49
20	8 57	8 41	8 28	8 17	8 08	8 01	7 47	7 35	7 24	7 14	7 02	6 49	6 41	6 33
21	10 09	9 50	9 35	9 22	9 12	9 03	8 47	8 33	8 20	8 08	7 54	7 39	7 30	7 20
22	11 12	10 51	10 35	10 22	10 11	10 01	9 44	9 29	9 16	9 02	8 47	8 31	8 21	8 10
23	12 05	11 45	11 29	11 15	11 04	10 54	10 38	10 23	10 09	9 55	9 41	9 24	9 14	9 03
24	12 49	12 30	12 15	12 03	11 52	11 43	11 27	11 13	11 00	10 47	10 33	10 18	10 08	9 58
25	13 25	13 08	12 55	12 44	12 35	12 27	12 13	12 01	11 49	11 38	11 25	11 11	11 03	10 54

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr. 1	3 02	3 10	3 15	3 20	3 24	3 28	3 34	3 39	3 45	3 50	3 55	4 01	4 04	4 08
2	4 07	4 11	4 13	4 16	4 18	4 19	4 22	4 25	4 27	4 30	4 32	4 35	4 36	4 38
3	5 13	5 12	5 12	5 11	5 11	5 11	5 10	5 10	5 10	5 09	5 09	5 08	5 08	5 08
4	6 18	6 14	6 10	6 08	6 05	6 03	5 59	5 56	5 52	5 49	5 46	5 42	5 40	5 37
5	7 25	7 16	7 10	7 04	7 00	6 56	6 48	6 42	6 36	6 30	6 24	6 17	6 13	6 08
6	8 31	8 19	8 10	8 02	7 55	7 49	7 39	7 30	7 21	7 13	7 04	6 54	6 48	6 41
7	9 37	9 22	9 10	9 00	8 51	8 43	8 30	8 19	8 08	7 58	7 47	7 34	7 26	7 18
8	10 41	10 23	10 09	9 57	9 47	9 38	9 23	9 10	8 57	8 45	8 32	8 17	8 08	7 58
9	11 42	11 22	11 06	10 53	10 42	10 33	10 16	10 02	9 48	9 35	9 21	9 04	8 54	8 44
10	12 37	12 17	12 01	11 48	11 36	11 27	11 10	10 55	10 41	10 27	10 13	9 56	9 46	9 34
11	13 26	13 06	12 51	12 39	12 28	12 19	12 03	11 48	11 35	11 22	11 08	10 51	10 42	10 31
12	14 07	13 51	13 37	13 26	13 17	13 09	12 54	12 42	12 30	12 18	12 05	11 51	11 42	11 32
13	14 43	14 30	14 19	14 10	14 03	13 56	13 44	13 34	13 25	13 15	13 04	12 53	12 46	12 38
14	15 14	15 05	14 58	14 51	14 46	14 41	14 33	14 26	14 19	14 12	14 05	13 57	13 52	13 46
15	15 42	15 37	15 34	15 30	15 28	15 25	15 21	15 17	15 14	15 10	15 06	15 02	14 59	14 56
16	16 09	16 09	16 09	16 09	16 09	16 09	16 09	16 09	16 08	16 08	16 08	16 08	16 08	16 08
17	16 35	16 40	16 44	16 47	16 50	16 52	16 56	17 00	17 03	17 07	17 11	17 15	17 17	17 20
18	17 04	17 13	17 20	17 27	17 32	17 37	17 45	17 52	17 59	18 06	18 13	18 21	18 26	18 31
19	17 36	17 49	18 00	18 09	18 16	18 23	18 35	18 45	18 55	19 05	19 15	19 27	19 34	19 42
20	18 12	18 29	18 43	18 54	19 04	19 12	19 27	19 39	19 51	20 03	20 16	20 30	20 39	20 49
21	18 55	19 14	19 30	19 43	19 53	20 03	20 19	20 34	20 47	21 00	21 15	21 31	21 40	21 51
22	19 44	20 05	20 21	20 34	20 46	20 56	21 13	21 28	21 41	21 55	22 10	22 27	22 37	22 48
23	20 40	21 00	21 16	21 29	21 40	21 49	22 06	22 20	22 34	22 47	23 02	23 18	23 28	23 39
24	21 40	21 58	22 12	22 24	22 34	22 43	22 59	23 12	23 24	23 36	23 50	.. ..	.. ..	.. ..
25	22 43	22 58	23 10	23 21	23 29	23 37	23 50	.. ..	.. ..	.. ..	.. ..	0 05	0 13	0 23

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2015
UNIVERSAL TIME FOR MERIDIAN OF GREENWICH
MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr. 1	15 49	15 48	15 46	15 45	15 43	15 41	15 39	15 37	15 35	15 32	15 30	15 26	15 23	15 18
2	16 44	16 44	16 44	16 43	16 43	16 42	16 42	16 41	16 41	16 40	16 39	16 39	16 38	16 37
3	17 40	17 41	17 42	17 42	17 43	17 44	17 45	17 46	17 47	17 49	17 50	17 52	17 53	17 56
4	18 37	18 39	18 40	18 42	18 44	18 46	18 49	18 51	18 54	18 57	19 01	19 05	19 10	19 15
5	19 34	19 37	19 39	19 42	19 46	19 49	19 53	19 57	20 02	20 07	20 13	20 19	20 27	20 36
6	20 32	20 35	20 39	20 43	20 47	20 52	20 57	21 03	21 09	21 16	21 24	21 33	21 44	21 57
7	21 30	21 34	21 38	21 43	21 48	21 54	22 01	22 07	22 15	22 24	22 34	22 46	23 00	23 17
8	22 27	22 32	22 37	22 42	22 48	22 55	23 02	23 10	23 19	23 29	23 41	23 54	.. ..	.. ..
9	23 22	23 27	23 33	23 39	23 45	23 52	23 59	.. ..	.. ..	.. ..	.. ..	.. ..	0 11	0 31
10	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 08	0 17	0 28	0 41	0 55	1 13	1 35
11	0 15	0 20	0 25	0 31	0 37	0 44	0 52	1 00	1 09	1 20	1 32	1 46	2 03	2 24
12	1 05	1 09	1 14	1 19	1 25	1 31	1 38	1 45	1 54	2 03	2 14	2 27	2 42	3 00
13	1 50	1 54	1 58	2 03	2 08	2 13	2 18	2 25	2 32	2 39	2 48	2 58	3 10	3 24
14	2 33	2 36	2 39	2 42	2 46	2 50	2 54	2 59	3 04	3 09	3 16	3 23	3 32	3 41
15	3 13	3 15	3 17	3 19	3 21	3 23	3 26	3 29	3 32	3 36	3 39	3 44	3 49	3 55
16	3 51	3 52	3 53	3 53	3 54	3 55	3 56	3 57	3 58	3 59	4 01	4 02	4 04	4 06
17	4 29	4 29	4 28	4 28	4 27	4 26	4 26	4 25	4 24	4 23	4 22	4 20	4 19	4 17
18	5 08	5 07	5 05	5 03	5 01	4 58	4 56	4 53	4 50	4 47	4 43	4 39	4 34	4 29
19	5 49	5 46	5 43	5 40	5 36	5 33	5 29	5 24	5 19	5 14	5 07	5 00	4 52	4 43
20	6 33	6 29	6 25	6 20	6 16	6 11	6 05	5 59	5 52	5 44	5 36	5 26	5 14	5 01
21	7 20	7 15	7 10	7 05	6 59	6 53	6 47	6 39	6 31	6 21	6 11	5 58	5 44	5 26
22	8 10	8 05	8 00	7 54	7 48	7 41	7 34	7 25	7 16	7 06	6 54	6 40	6 23	6 02
23	9 03	8 58	8 53	8 47	8 41	8 34	8 26	8 18	8 09	7 58	7 46	7 31	7 14	6 53
24	9 58	9 53	9 48	9 43	9 37	9 30	9 23	9 15	9 07	8 57	8 45	8 32	8 16	7 56
25	10 54	10 49	10 45	10 40	10 35	10 29	10 23	10 16	10 09	10 00	9 50	9 39	9 25	9 09

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr. 1	4 08	4 10	4 12	4 14	4 16	4 18	4 21	4 23	4 26	4 30	4 33	4 38	4 42	4 48
2	4 38	4 39	4 40	4 41	4 42	4 43	4 44	4 45	4 47	4 48	4 50	4 52	4 54	4 56
3	5 08	5 07	5 07	5 07	5 07	5 07	5 07	5 06	5 06	5 06	5 05	5 05	5 05	5 04
4	5 37	5 36	5 35	5 34	5 32	5 31	5 29	5 28	5 26	5 24	5 21	5 19	5 16	5 12
5	6 08	6 06	6 04	6 02	5 59	5 57	5 54	5 50	5 47	5 43	5 38	5 34	5 28	5 21
6	6 41	6 38	6 35	6 32	6 28	6 24	6 20	6 16	6 10	6 05	5 58	5 51	5 42	5 32
7	7 18	7 14	7 10	7 06	7 01	6 56	6 50	6 44	6 38	6 30	6 22	6 12	6 00	5 47
8	7 58	7 54	7 49	7 44	7 38	7 32	7 26	7 19	7 10	7 01	6 51	6 39	6 24	6 07
9	8 44	8 39	8 33	8 28	8 22	8 15	8 08	8 00	7 50	7 40	7 28	7 14	6 58	6 37
10	9 34	9 29	9 24	9 18	9 12	9 05	8 57	8 49	8 39	8 28	8 16	8 01	7 44	7 22
11	10 31	10 26	10 21	10 15	10 09	10 02	9 55	9 47	9 38	9 27	9 15	9 01	8 44	8 23
12	11 32	11 28	11 23	11 18	11 13	11 07	11 00	10 53	10 45	10 36	10 25	10 13	9 59	9 41
13	12 38	12 34	12 30	12 26	12 22	12 17	12 12	12 06	12 00	11 53	11 44	11 35	11 24	11 10
14	13 46	13 44	13 41	13 38	13 35	13 32	13 28	13 24	13 20	13 15	13 09	13 02	12 55	12 46
15	14 56	14 55	14 54	14 52	14 51	14 49	14 47	14 45	14 42	14 40	14 37	14 34	14 30	14 25
16	16 08	16 08	16 08	16 08	16 08	16 08	16 07	16 07	16 07	16 07	16 07	16 07	16 07	16 06
17	17 20	17 21	17 22	17 24	17 25	17 27	17 28	17 30	17 33	17 35	17 38	17 40	17 44	17 48
18	18 31	18 34	18 36	18 39	18 42	18 45	18 49	18 53	18 57	19 02	19 07	19 13	19 20	19 29
19	19 42	19 45	19 49	19 53	19 57	20 02	20 07	20 13	20 19	20 26	20 34	20 43	20 54	21 07
20	20 49	20 53	20 58	21 03	21 08	21 14	21 20	21 27	21 35	21 44	21 55	22 07	22 21	22 38
21	21 51	21 56	22 01	22 07	22 13	22 19	22 27	22 35	22 44	22 54	23 06	23 20	23 36	23 57
22	22 48	22 53	22 58	23 04	23 10	23 17	23 25	23 33	23 43	23 53	.. ..	.. ..	.. ..	.. ..
23	23 39	23 43	23 48	23 54	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 05	0 20	0 37	0 59
24	.. ..	.. ..	.. ..	.. ..	0 00	0 07	0 14	0 22	0 31	0 41	0 53	1 06	1 23	1 42
25	0 23	0 27	0 32	0 37	0 43	0 48	0 55	1 02	1 10	1 19	1 29	1 41	1 55	2 12

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2015
UNIVERSAL TIME FOR MERIDIAN OF GREENWICH
MOONRISE

Lat.	-55	-50°	-45	-40°	-35°	-30°	-20°	-10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr. 24	12 49	12 30	12 15	12 03	11 52	11 43	11 27	11 13	11 00	10 47	10 33	10 18	10 08	9 58
	13 25	13 08	12 55	12 44	12 35	12 27	12 13	12 01	11 49	11 38	11 25	11 11	11 03	10 54
	13 54	13 41	13 30	13 22	13 14	13 07	12 56	12 45	12 36	12 26	12 16	12 04	11 57	11 50
	14 19	14 10	14 02	13 55	13 49	13 44	13 35	13 28	13 20	13 13	13 05	12 56	12 51	12 46
	14 42	14 36	14 30	14 26	14 22	14 19	14 13	14 08	14 04	13 59	13 54	13 48	13 45	13 41
May 29	15 03	15 00	14 58	14 56	14 54	14 53	14 50	14 48	14 46	14 44	14 42	14 40	14 38	14 37
	15 23	15 24	15 25	15 25	15 26	15 26	15 27	15 28	15 29	15 29	15 30	15 31	15 32	15 32
	15 44	15 48	15 52	15 55	15 58	16 00	16 04	16 08	16 12	16 15	16 19	16 23	16 26	16 29
	16 06	16 14	16 21	16 26	16 31	16 35	16 43	16 50	16 56	17 02	17 09	17 17	17 21	17 26
	16 31	16 43	16 52	17 00	17 07	17 13	17 24	17 33	17 42	17 51	18 00	18 11	18 17	18 24
May 4	17 00	17 15	17 27	17 38	17 46	17 54	18 07	18 19	18 30	18 41	18 52	19 06	19 14	19 23
	17 35	17 53	18 08	18 19	18 30	18 38	18 54	19 07	19 20	19 33	19 46	20 02	20 11	20 21
	18 18	18 38	18 53	19 06	19 17	19 27	19 44	19 58	20 12	20 26	20 40	20 57	21 07	21 18
	19 09	19 30	19 46	19 59	20 10	20 20	20 37	20 52	21 06	21 19	21 34	21 51	22 01	22 13
	20 09	20 29	20 44	20 57	21 07	21 17	21 33	21 47	22 00	22 13	22 27	22 43	22 53	23 03
May 9	21 17	21 34	21 47	21 58	22 08	22 16	22 30	22 43	22 54	23 06	23 18	23 32	23 40	23 50
	22 31	22 44	22 55	23 03	23 11	23 18	23 29	23 39	23 48	23 57	.. ..	.. ..	.. ..	.. ..
	23 48	23 57	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 07	0 19	0 25	0 32
	.. ..	.. ..	0 04	0 10	0 16	0 20	0 28	0 35	0 41	0 48	0 55	1 02	1 07	1 12
	1 08	1 12	1 16	1 19	1 21	1 24	1 27	1 31	1 34	1 37	1 41	1 45	1 47	1 50
May 14	2 29	2 28	2 28	2 28	2 28	2 28	2 27	2 27	2 27	2 27	2 27	2 26	2 26	2 26
	3 50	3 45	3 41	3 38	3 35	3 32	3 28	3 24	3 20	3 16	3 13	3 08	3 06	3 03
	5 12	5 02	4 54	4 47	4 42	4 37	4 28	4 21	4 14	4 07	4 00	3 52	3 47	3 42
	6 31	6 17	6 06	5 56	5 48	5 41	5 29	5 19	5 09	4 59	4 49	4 37	4 31	4 23
	7 47	7 29	7 15	7 03	6 53	6 45	6 30	6 17	6 05	5 53	5 40	5 26	5 17	5 08

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr. 24	21 40	21 58	22 12	22 24	22 34	22 43	22 59	23 12	23 24	23 36	23 50	.. ..	.. ..	.. ..
	22 43	22 58	23 10	23 21	23 29	23 37	23 50	.. ..	.. ..	.. ..	.. ..	0 05	0 13	0 23
	23 47	23 59	.. ..	.. ..	.. ..	.. ..	.. ..	0 01	0 12	0 23	0 34	0 47	0 54	1 02
	.. ..	.. ..	0 09	0 17	0 23	0 30	0 40	0 49	0 58	1 06	1 15	1 25	1 31	1 38
	0 51	1 00	1 07	1 12	1 17	1 21	1 29	1 35	1 41	1 47	1 54	2 01	2 05	2 10
May 29	1 56	2 01	2 05	2 08	2 11	2 13	2 17	2 21	2 24	2 28	2 31	2 35	2 38	2 40
	3 01	3 02	3 03	3 03	3 04	3 04	3 05	3 06	3 07	3 07	3 08	3 09	3 09	3 10
	4 07	4 04	4 01	3 59	3 58	3 56	3 54	3 51	3 49	3 47	3 45	3 42	3 41	3 39
	5 13	5 06	5 01	4 56	4 52	4 49	4 43	4 38	4 33	4 28	4 23	4 17	4 13	4 09
	6 20	6 09	6 01	5 54	5 48	5 43	5 33	5 25	5 18	5 10	5 02	4 53	4 48	4 42
May 4	7 27	7 13	7 02	6 52	6 44	6 37	6 25	6 14	6 05	5 55	5 44	5 32	5 25	5 17
	8 33	8 16	8 02	7 51	7 41	7 33	7 18	7 05	6 54	6 42	6 29	6 14	6 06	5 57
	9 36	9 17	9 01	8 49	8 38	8 28	8 12	7 58	7 45	7 31	7 17	7 01	6 52	6 41
	10 34	10 14	9 58	9 44	9 33	9 23	9 06	8 51	8 38	8 24	8 09	7 52	7 42	7 30
	11 25	11 05	10 50	10 37	10 26	10 16	10 00	9 45	9 32	9 18	9 03	8 47	8 37	8 26
May 9	12 09	11 51	11 37	11 25	11 15	11 07	10 52	10 38	10 26	10 13	10 00	9 45	9 36	9 25
	12 46	12 31	12 20	12 10	12 02	11 54	11 42	11 31	11 20	11 09	10 58	10 45	10 38	10 29
	13 17	13 07	12 58	12 51	12 45	12 39	12 30	12 21	12 14	12 06	11 57	11 47	11 42	11 35
	13 45	13 39	13 34	13 29	13 26	13 22	13 17	13 11	13 07	13 02	12 56	12 50	12 47	12 43
	14 11	14 09	14 08	14 06	14 05	14 04	14 02	14 01	13 59	13 58	13 56	13 54	13 53	13 52
May 14	14 36	14 39	14 41	14 43	14 44	14 46	14 48	14 50	14 52	14 54	14 56	14 58	14 59	15 01
	15 03	15 10	15 16	15 21	15 25	15 28	15 35	15 40	15 46	15 51	15 56	16 03	16 07	16 11
	15 32	15 43	15 53	16 00	16 07	16 13	16 23	16 32	16 40	16 48	16 57	17 08	17 13	17 20
	16 05	16 21	16 33	16 43	16 52	17 00	17 13	17 25	17 36	17 47	17 58	18 12	18 19	18 28
	16 45	17 03	17 18	17 30	17 40	17 49	18 05	18 19	18 32	18 44	18 58	19 14	19 23	19 33

.. .. indicates phenomenon will occur the next day.

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr. 24	9 58	9 53	9 48	9 43	9 37	9 30	9 23	9 15	9 07	8 57	8 45	8 32	8 16	7 56
25	10 54	10 49	10 45	10 40	10 35	10 29	10 23	10 16	10 09	10 00	9 50	9 39	9 25	9 09
26	11 50	11 46	11 43	11 39	11 34	11 30	11 25	11 19	11 13	11 06	10 58	10 49	10 38	10 25
27	12 46	12 43	12 40	12 37	12 34	12 31	12 27	12 23	12 18	12 13	12 07	12 00	11 53	11 44
28	13 41	13 39	13 38	13 36	13 34	13 31	13 29	13 26	13 23	13 20	13 16	13 12	13 08	13 02
29	14 37	14 36	14 35	14 34	14 33	14 33	14 32	14 30	14 29	14 28	14 26	14 25	14 23	14 20
30	15 32	15 33	15 33	15 33	15 34	15 34	15 34	15 35	15 35	15 36	15 37	15 37	15 38	15 39
May 1	16 29	16 30	16 31	16 33	16 34	16 36	16 38	16 40	16 42	16 45	16 48	16 51	16 55	16 59
2	17 26	17 28	17 31	17 33	17 36	17 39	17 42	17 46	17 50	17 55	18 00	18 05	18 12	18 20
3	18 24	18 27	18 31	18 34	18 38	18 43	18 47	18 53	18 58	19 05	19 12	19 20	19 30	19 42
4	19 23	19 27	19 31	19 36	19 41	19 46	19 52	19 59	20 06	20 14	20 24	20 35	20 48	21 03
5	20 21	20 26	20 31	20 36	20 42	20 48	20 55	21 03	21 12	21 22	21 33	21 46	22 02	22 21
6	21 18	21 23	21 29	21 34	21 41	21 48	21 55	22 04	22 13	22 24	22 36	22 51	23 08	23 30
7	22 13	22 18	22 23	22 29	22 35	22 42	22 50	22 58	23 08	23 19	23 31	23 46	.. ..	.. ..
8	23 03	23 08	23 13	23 18	23 24	23 31	23 38	23 46	23 55	.. ..	.. ..	.. ..	0 03	0 25
9	23 50	23 54	23 58	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 05	0 16	0 29	0 45	1 05
10	.. ..	.. ..	.. ..	0 03	0 08	0 14	0 20	0 27	0 34	0 42	0 52	1 03	1 16	1 31
11	0 32	0 36	0 39	0 43	0 47	0 51	0 56	1 01	1 07	1 14	1 21	1 29	1 39	1 50
12	1 12	1 14	1 17	1 19	1 22	1 25	1 28	1 32	1 36	1 40	1 45	1 50	1 57	2 04
13	1 50	1 51	1 52	1 53	1 55	1 56	1 58	1 59	2 01	2 04	2 06	2 09	2 12	2 15
14	2 26	2 26	2 26	2 26	2 26	2 26	2 26	2 26	2 26	2 26	2 26	2 26	2 26	2 26
15	3 03	3 02	3 01	2 59	2 58	2 56	2 55	2 53	2 51	2 48	2 46	2 43	2 40	2 36
16	3 42	3 39	3 37	3 34	3 31	3 28	3 25	3 21	3 17	3 13	3 08	3 02	2 56	2 48
17	4 23	4 20	4 16	4 12	4 08	4 04	3 59	3 53	3 47	3 41	3 33	3 25	3 15	3 03
18	5 08	5 04	4 59	4 54	4 49	4 43	4 37	4 30	4 23	4 14	4 04	3 53	3 40	3 24

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr. 24	.. ..	.. ..	.. ..	.. ..	0 00	0 07	0 14	0 22	0 31	0 41	0 53	1 06	1 23	1 42
25	0 23	0 27	0 32	0 37	0 43	0 48	0 55	1 02	1 10	1 19	1 29	1 41	1 55	2 12
26	1 02	1 06	1 10	1 14	1 19	1 24	1 29	1 35	1 42	1 49	1 58	2 08	2 19	2 32
27	1 38	1 41	1 44	1 47	1 51	1 54	1 59	2 03	2 09	2 14	2 21	2 28	2 37	2 46
28	2 10	2 12	2 14	2 16	2 19	2 22	2 25	2 28	2 31	2 35	2 40	2 45	2 51	2 57
29	2 40	2 41	2 42	2 44	2 45	2 47	2 48	2 50	2 52	2 54	2 57	2 59	3 03	3 06
30	3 10	3 10	3 10	3 10	3 10	3 11	3 11	3 11	3 12	3 12	3 12	3 13	3 13	3 14
May 1	3 39	3 38	3 37	3 37	3 36	3 35	3 34	3 32	3 31	3 30	3 28	3 26	3 24	3 22
2	4 09	4 08	4 06	4 04	4 02	4 00	3 57	3 54	3 51	3 48	3 45	3 40	3 36	3 30
3	4 42	4 39	4 36	4 33	4 30	4 27	4 23	4 19	4 14	4 09	4 03	3 57	3 49	3 40
4	5 17	5 14	5 10	5 06	5 02	4 57	4 52	4 46	4 40	4 33	4 25	4 16	4 06	3 53
5	5 57	5 52	5 48	5 43	5 38	5 32	5 26	5 19	5 11	5 02	4 52	4 41	4 27	4 11
6	6 41	6 36	6 31	6 25	6 19	6 13	6 06	5 58	5 49	5 39	5 27	5 14	4 58	4 38
7	7 30	7 25	7 20	7 14	7 08	7 01	6 53	6 45	6 35	6 24	6 12	5 57	5 39	5 17
8	8 26	8 21	8 15	8 09	8 03	7 56	7 49	7 40	7 31	7 20	7 08	6 53	6 36	6 14
9	9 25	9 21	9 16	9 11	9 05	8 59	8 52	8 44	8 36	8 26	8 15	8 02	7 46	7 27
10	10 29	10 25	10 21	10 17	10 12	10 07	10 01	9 55	9 47	9 40	9 30	9 20	9 08	8 53
11	11 35	11 32	11 29	11 26	11 22	11 18	11 14	11 09	11 04	10 58	10 52	10 44	10 35	10 25
12	12 43	12 41	12 39	12 37	12 35	12 33	12 30	12 27	12 24	12 20	12 16	12 12	12 07	12 01
13	13 52	13 51	13 50	13 50	13 49	13 48	13 47	13 46	13 45	13 44	13 43	13 41	13 40	13 38
14	15 01	15 02	15 02	15 03	15 04	15 05	15 06	15 07	15 08	15 09	15 10	15 12	15 14	15 16
15	16 11	16 13	16 15	16 17	16 19	16 21	16 24	16 27	16 30	16 34	16 38	16 43	16 48	16 55
16	17 20	17 23	17 26	17 30	17 33	17 37	17 42	17 47	17 52	17 58	18 05	18 13	18 22	18 32
17	18 28	18 32	18 36	18 41	18 46	18 51	18 57	19 04	19 11	19 19	19 28	19 39	19 52	20 07
18	19 33	19 38	19 43	19 48	19 54	20 00	20 07	20 15	20 24	20 34	20 45	20 58	21 14	21 33

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2015
UNIVERSAL TIME FOR MERIDIAN OF GREENWICH
MOONRISE

Lat.	-55°	-50°	-45°	-40°	-35°	-30°	-20°	-10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
May 17	6 31	6 17	6 06	5 56	5 48	5 41	5 29	5 19	5 09	4 59	4 49	4 37	4 31	4 23
18	7 47	7 29	7 15	7 03	6 53	6 45	6 30	6 17	6 05	5 53	5 40	5 26	5 17	5 08
19	8 55	8 35	8 19	8 06	7 55	7 45	7 29	7 14	7 01	6 47	6 33	6 17	6 07	5 57
20	9 54	9 33	9 17	9 03	8 52	8 42	8 25	8 10	7 56	7 42	7 27	7 10	7 00	6 49
21	10 43	10 23	10 08	9 55	9 44	9 34	9 17	9 03	8 49	8 36	8 21	8 05	7 55	7 44
22	11 23	11 05	10 51	10 40	10 30	10 21	10 06	9 53	9 40	9 28	9 15	9 00	8 51	8 41
23	11 56	11 41	11 29	11 19	11 11	11 04	10 51	10 39	10 29	10 18	10 07	9 54	9 46	9 38
24	12 23	12 12	12 03	11 55	11 48	11 42	11 32	11 23	11 15	11 07	10 58	10 47	10 42	10 35
25	12 47	12 39	12 32	12 27	12 23	12 18	12 11	12 05	11 59	11 53	11 47	11 40	11 36	11 31
26	13 08	13 04	13 00	12 57	12 55	12 53	12 49	12 45	12 42	12 39	12 35	12 32	12 29	12 27
27	13 28	13 28	13 27	13 27	13 26	13 26	13 25	13 25	13 24	13 24	13 24	13 23	13 23	13 22
28	13 48	13 51	13 54	13 56	13 58	13 59	14 02	14 05	14 07	14 09	14 12	14 15	14 17	14 18
29	14 10	14 16	14 22	14 26	14 30	14 34	14 40	14 45	14 50	14 56	15 01	15 07	15 11	15 15
30	14 33	14 44	14 52	14 59	15 05	15 10	15 20	15 28	15 36	15 43	15 52	16 01	16 07	16 13
31	15 00	15 14	15 26	15 35	15 43	15 50	16 02	16 13	16 23	16 33	16 44	16 56	17 04	17 12
June 1	15 33	15 50	16 04	16 15	16 25	16 33	16 48	17 01	17 13	17 25	17 38	17 53	18 01	18 11
2	16 13	16 32	16 48	17 00	17 11	17 21	17 37	17 51	18 05	18 18	18 33	18 49	18 59	19 10
3	17 02	17 22	17 38	17 52	18 03	18 13	18 30	18 45	18 59	19 13	19 28	19 45	19 55	20 07
4	18 00	18 20	18 36	18 49	19 00	19 10	19 26	19 41	19 54	20 08	20 23	20 39	20 49	21 00
5	19 07	19 25	19 39	19 51	20 01	20 09	20 24	20 38	20 50	21 02	21 15	21 30	21 39	21 49
6	20 20	20 34	20 46	20 56	21 04	21 11	21 24	21 35	21 45	21 55	22 06	22 18	22 25	22 33
7	21 37	21 47	21 56	22 03	22 09	22 14	22 23	22 31	22 39	22 46	22 54	23 03	23 08	23 14
8	22 55	23 01	23 06	23 10	23 14	23 17	23 27	23 37	23 31	23 36	23 40	23 46	23 49	23 52
9	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
10	0 15	0 16	0 17	0 18	0 19	0 20	0 21	0 22	0 23	0 24	0 25	0 27	0 27	0 28

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
May 17	16 05	16 21	16 33	16 43	16 52	17 00	17 13	17 25	17 36	17 47	17 58	18 12	18 19	18 28
18	16 45	17 03	17 18	17 30	17 40	17 49	18 05	18 19	18 32	18 44	18 58	19 14	19 23	19 33
19	17 31	17 51	18 07	18 21	18 32	18 42	18 59	19 13	19 27	19 41	19 56	20 13	20 23	20 34
20	18 24	18 45	19 01	19 15	19 26	19 36	19 53	20 08	20 22	20 36	20 50	21 07	21 17	21 28
21	19 23	19 43	19 58	20 11	20 22	20 31	20 47	21 01	21 14	21 27	21 41	21 57	22 06	22 17
22	20 26	20 43	20 57	21 08	21 18	21 26	21 40	21 52	22 04	22 16	22 28	22 42	22 50	22 59
23	21 31	21 45	21 56	22 05	22 13	22 20	22 32	22 42	22 51	23 01	23 11	23 22	23 29	23 37
24	22 37	22 47	22 55	23 02	23 08	23 13	23 22	23 29	23 37	23 44	23 51	.. ..	.. ..	.. ..
25	23 42	23 48	23 54	23 58	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 00	0 05	0 10
26	.. ..	.. ..	.. ..	.. ..	0 02	0 05	0 11	0 15	0 20	0 25	0 29	0 35	0 38	0 41
27	0 47	0 50	0 52	0 54	0 55	0 56	0 59	1 01	1 03	1 04	1 06	1 08	1 10	1 11
28	1 52	1 51	1 50	1 49	1 49	1 48	1 47	1 46	1 45	1 44	1 43	1 42	1 41	1 40
29	2 58	2 53	2 49	2 46	2 43	2 40	2 36	2 32	2 28	2 24	2 20	2 16	2 13	2 10
30	4 05	3 56	3 49	3 43	3 38	3 33	3 25	3 18	3 12	3 05	2 59	2 51	2 46	2 41
31	5 13	5 00	4 50	4 41	4 34	4 28	4 17	4 07	3 58	3 49	3 39	3 29	3 22	3 15
June 1	6 20	6 04	5 51	5 40	5 31	5 23	5 10	4 58	4 46	4 35	4 23	4 10	4 02	3 53
2	7 26	7 07	6 52	6 39	6 29	6 20	6 04	5 50	5 37	5 25	5 11	4 55	4 46	4 36
3	8 27	8 06	7 50	7 37	7 26	7 16	6 59	6 44	6 31	6 17	6 02	5 45	5 35	5 24
4	9 22	9 01	8 45	8 32	8 21	8 11	7 54	7 39	7 25	7 11	6 57	6 39	6 29	6 18
5	10 09	9 50	9 36	9 23	9 13	9 04	8 48	8 34	8 21	8 08	7 54	7 38	7 28	7 18
6	10 49	10 33	10 21	10 10	10 01	9 53	9 40	9 28	9 16	9 05	8 53	8 39	8 30	8 21
7	11 22	11 10	11 01	10 53	10 46	10 40	10 29	10 19	10 11	10 02	9 52	9 41	9 35	9 27
8	11 51	11 43	11 37	11 32	11 27	11 23	11 16	11 10	11 04	10 58	10 51	10 44	10 40	10 35
9	12 17	12 14	12 11	12 09	12 07	12 05	12 01	11 59	11 56	11 53	11 50	11 47	11 45	11 43
10	12 42	12 43	12 44	12 44	12 45	12 45	12 46	12 47	12 48	12 48	12 49	12 50	12 50	12 51

.. .. indicates phenomenon will occur the next day.

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
May 17	4 23	4 20	4 16	4 12	4 08	4 04	3 59	3 53	3 47	3 41	3 33	3 25	3 15	3 03
18	5 08	5 04	4 59	4 54	4 49	4 43	4 37	4 30	4 23	4 14	4 04	3 53	3 40	3 24
19	5 57	5 52	5 47	5 41	5 35	5 29	5 21	5 13	5 05	4 54	4 43	4 30	4 14	3 54
20	6 49	6 44	6 38	6 33	6 26	6 19	6 12	6 03	5 54	5 43	5 31	5 16	4 59	4 37
21	7 44	7 39	7 34	7 28	7 22	7 15	7 08	7 00	6 50	6 40	6 28	6 14	5 57	5 36
22	8 41	8 36	8 31	8 26	8 21	8 15	8 08	8 00	7 52	7 43	7 32	7 19	7 04	6 46
23	9 38	9 34	9 30	9 26	9 21	9 16	9 10	9 04	8 57	8 49	8 40	8 30	8 18	8 03
24	10 35	10 32	10 29	10 25	10 21	10 17	10 13	10 08	10 03	9 57	9 50	9 42	9 33	9 22
25	11 31	11 29	11 27	11 24	11 22	11 19	11 16	11 13	11 09	11 05	11 00	10 55	10 49	10 42
26	12 27	12 26	12 24	12 23	12 22	12 20	12 19	12 17	12 15	12 13	12 10	12 08	12 04	12 01
27	13 22	13 22	13 22	13 22	13 22	13 22	13 21	13 21	13 21	13 21	13 20	13 20	13 20	13 19
28	14 18	14 19	14 20	14 21	14 22	14 23	14 25	14 26	14 27	14 29	14 31	14 33	14 36	14 38
29	15 15	15 17	15 19	15 21	15 23	15 26	15 29	15 32	15 35	15 38	15 43	15 47	15 53	15 59
30	16 13	16 16	16 19	16 22	16 26	16 29	16 33	16 38	16 43	16 49	16 55	17 02	17 11	17 21
31	17 12	17 16	17 20	17 24	17 28	17 33	17 39	17 45	17 52	17 59	18 08	18 18	18 29	18 43
June 1	18 11	18 16	18 20	18 25	18 31	18 37	18 44	18 51	18 59	19 09	19 19	19 32	19 47	20 05
2	19 10	19 15	19 20	19 26	19 32	19 39	19 46	19 55	20 04	20 14	20 27	20 41	20 58	21 20
3	20 07	20 12	20 17	20 23	20 30	20 37	20 44	20 53	21 03	21 14	21 26	21 41	21 59	22 22
4	21 00	21 05	21 10	21 16	21 22	21 29	21 36	21 44	21 54	22 04	22 16	22 30	22 47	23 08
5	21 49	21 53	21 58	22 03	22 09	22 15	22 21	22 28	22 36	22 45	22 56	23 08	23 22	23 39
6	22 33	22 37	22 41	22 45	22 50	22 54	23 00	23 05	23 12	23 19	23 27	23 37	23 47	.. ..
7	23 14	23 17	23 20	23 23	23 26	23 29	23 33	23 37	23 42	23 47	23 53	23 59	.. ..	0 00
8	23 52	23 54	23 55	23 57	23 59	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 07	0 15
9	.. ..	.. ..	.. ..	.. ..	.. ..	0 01	0 03	0 05	0 08	0 11	0 14	0 18	0 22	0 27
10	0 28	0 29	0 29	0 29	0 30	0 30	0 31	0 32	0 32	0 33	0 34	0 35	0 36	0 37

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
May 17	18 28	18 32	18 36	18 41	18 46	18 51	18 57	19 04	19 11	19 19	19 28	19 39	19 52	20 07
18	19 33	19 38	19 43	19 48	19 54	20 00	20 07	20 15	20 24	20 34	20 45	20 58	21 14	21 33
19	20 34	20 39	20 44	20 50	20 56	21 03	21 10	21 19	21 28	21 39	21 51	22 06	22 23	22 45
20	21 28	21 33	21 39	21 44	21 51	21 57	22 05	22 13	22 23	22 33	22 45	23 00	23 17	23 38
21	22 17	22 21	22 26	22 32	22 37	22 44	22 51	22 58	23 07	23 17	23 28	23 40	23 56	.. ..
22	22 59	23 03	23 07	23 12	23 17	23 23	23 29	23 35	23 43	23 51	.. ..	.. ..	.. ..	0 14
23	23 37	23 40	23 43	23 47	23 51	23 56	.. ..	.. ..	.. ..	.. ..	0 00	0 11	0 24	0 39
24	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 00	0 06	0 12	0 18	0 26	0 34	0 44	0 55
25	0 10	0 13	0 15	0 18	0 21	0 24	0 28	0 32	0 36	0 41	0 46	0 52	0 59	1 07
26	0 41	0 43	0 45	0 46	0 48	0 50	0 53	0 55	0 58	1 01	1 04	1 08	1 12	1 17
27	1 11	1 12	1 12	1 13	1 14	1 15	1 15	1 16	1 17	1 19	1 20	1 21	1 23	1 25
28	1 40	1 40	1 40	1 39	1 39	1 38	1 38	1 37	1 37	1 36	1 35	1 34	1 33	1 32
29	2 10	2 09	2 07	2 06	2 04	2 02	2 01	1 59	1 56	1 54	1 51	1 48	1 44	1 40
30	2 41	2 39	2 37	2 34	2 31	2 28	2 25	2 22	2 18	2 13	2 08	2 03	1 57	1 49
31	3 15	3 12	3 09	3 05	3 01	2 57	2 52	2 47	2 42	2 36	2 29	2 21	2 11	2 01
June 1	3 53	3 49	3 45	3 40	3 35	3 30	3 24	3 18	3 10	3 02	2 53	2 43	2 31	2 16
2	4 36	4 31	4 26	4 21	4 15	4 09	4 02	3 54	3 46	3 36	3 25	3 12	2 57	2 38
3	5 24	5 19	5 13	5 08	5 01	4 54	4 47	4 38	4 29	4 18	4 06	3 51	3 34	3 12
4	6 18	6 13	6 07	6 02	5 55	5 48	5 40	5 32	5 22	5 11	4 59	4 44	4 26	4 03
5	7 18	7 13	7 08	7 02	6 56	6 49	6 42	6 34	6 25	6 15	6 03	5 49	5 33	5 12
6	8 21	8 17	8 13	8 08	8 03	7 57	7 51	7 44	7 36	7 27	7 18	7 06	6 52	6 36
7	9 27	9 24	9 21	9 17	9 13	9 08	9 04	8 58	8 52	8 46	8 38	8 30	8 20	8 08
8	10 35	10 32	10 30	10 28	10 25	10 22	10 19	10 15	10 12	10 07	10 02	9 57	9 50	9 43
9	11 43	11 42	11 40	11 39	11 38	11 37	11 35	11 34	11 32	11 30	11 28	11 25	11 22	11 19
10	12 51	12 51	12 51	12 51	12 51	12 52	12 52	12 52	12 53	12 53	12 53	12 54	12 54	12 55

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2015
UNIVERSAL TIME FOR MERIDIAN OF GREENWICH
MOONRISE

Lat.	-55°	-50°	-45°	-40°	-35°	-30°	-20°	-10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
June 8	22 55	23 01	23 06	23 10	23 14	23 17	23 22	23 27	23 31	23 36	23 40	23 46	23 49	23 52
9	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
10	0 15	0 16	0 17	0 18	0 19	0 20	0 21	0 22	0 23	0 24	0 25	0 27	0 27	0 28
11	1 35	1 31	1 28	1 26	1 24	1 23	1 20	1 17	1 15	1 12	1 10	1 07	1 06	1 04
12	2 54	2 46	2 39	2 34	2 30	2 26	2 19	2 13	2 07	2 01	1 55	1 49	1 45	1 41
13	4 12	4 00	3 50	3 42	3 35	3 28	3 18	3 09	3 00	2 51	2 42	2 32	2 26	2 19
14	5 28	5 11	4 58	4 48	4 39	4 31	4 17	4 05	3 54	3 43	3 31	3 18	3 10	3 01
15	6 38	6 19	6 04	5 51	5 41	5 31	5 16	5 02	4 49	4 36	4 22	4 07	3 57	3 47
16	7 41	7 21	7 04	6 51	6 39	6 29	6 12	5 58	5 44	5 30	5 15	4 58	4 48	4 37
17	8 35	8 15	7 58	7 45	7 34	7 24	7 07	6 52	6 38	6 24	6 09	5 52	5 42	5 31
18	9 20	9 01	8 46	8 33	8 23	8 13	7 57	7 43	7 30	7 17	7 03	6 47	6 38	6 27
19	9 56	9 40	9 27	9 16	9 06	8 58	8 44	8 32	8 20	8 09	7 56	7 42	7 34	7 25
20	10 26	10 13	10 02	9 53	9 46	9 39	9 28	9 18	9 08	8 59	8 48	8 37	8 30	8 22
21	10 51	10 42	10 34	10 27	10 22	10 17	10 08	10 01	9 54	9 46	9 39	9 30	9 25	9 19
22	11 13	11 07	11 03	10 59	10 55	10 52	10 47	10 42	10 37	10 33	10 28	10 23	10 19	10 16
23	11 34	11 32	11 30	11 28	11 27	11 26	11 24	11 22	11 20	11 18	11 16	11 14	11 13	11 12
24	11 54	11 55	11 56	11 57	11 58	11 59	12 00	12 01	12 02	12 03	12 04	12 06	12 07	12 07
25	12 14	12 19	12 23	12 27	12 30	12 32	12 37	12 41	12 45	12 49	12 53	12 58	13 00	13 03
26	12 37	12 45	12 52	12 58	13 03	13 08	13 15	13 22	13 29	13 35	13 42	13 50	13 55	14 00
27	13 02	13 14	13 24	13 32	13 39	13 45	13 56	14 06	14 15	14 24	14 33	14 44	14 51	14 58
28	13 31	13 47	13 59	14 10	14 18	14 26	14 40	14 52	15 03	15 14	15 26	15 40	15 48	15 57
29	14 07	14 26	14 40	14 52	15 03	15 12	15 27	15 41	15 54	16 07	16 21	16 37	16 46	16 56
30	14 52	15 12	15 28	15 41	15 52	16 02	16 19	16 34	16 48	17 02	17 16	17 33	17 43	17 55
July 1	15 46	16 07	16 23	16 36	16 48	16 58	17 15	17 29	17 43	17 57	18 12	18 29	18 39	18 51
2	16 51	17 10	17 25	17 38	17 48	17 57	18 13	18 27	18 40	18 53	19 07	19 23	19 32	19 43

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
June 8	11 51	11 43	11 37	11 32	11 27	11 23	11 16	11 10	11 04	10 58	10 51	10 44	10 40	10 35
9	12 17	12 14	12 11	12 09	12 07	12 05	12 01	11 59	11 56	11 53	11 50	11 47	11 45	11 43
10	12 42	12 43	12 44	12 44	12 45	12 45	12 46	12 47	12 48	12 48	12 49	12 50	12 50	12 51
11	13 07	13 13	13 17	13 21	13 24	13 26	13 31	13 36	13 40	13 44	13 48	13 53	13 55	13 59
12	13 34	13 44	13 52	13 58	14 04	14 09	14 17	14 25	14 32	14 39	14 47	14 56	15 01	15 06
13	14 04	14 18	14 29	14 38	14 46	14 53	15 05	15 16	15 26	15 35	15 46	15 58	16 05	16 13
14	14 40	14 57	15 11	15 22	15 32	15 40	15 55	16 08	16 20	16 32	16 45	17 00	17 08	17 18
15	15 22	15 42	15 57	16 10	16 21	16 31	16 47	17 02	17 15	17 29	17 43	17 59	18 09	18 20
16	16 11	16 32	16 49	17 02	17 14	17 24	17 41	17 56	18 10	18 24	18 39	18 56	19 06	19 17
17	17 08	17 28	17 44	17 57	18 08	18 18	18 35	18 50	19 03	19 17	19 31	19 48	19 57	20 08
18	18 09	18 28	18 42	18 54	19 05	19 14	19 29	19 42	19 55	20 07	20 20	20 35	20 44	20 54
19	19 14	19 30	19 42	19 52	20 01	20 09	20 22	20 33	20 44	20 54	21 05	21 18	21 26	21 34
20	20 20	20 32	20 42	20 50	20 57	21 03	21 13	21 22	21 30	21 39	21 47	21 57	22 03	22 10
21	21 26	21 35	21 41	21 47	21 51	21 56	22 03	22 09	22 15	22 21	22 27	22 34	22 38	22 42
22	22 32	22 36	22 40	22 43	22 45	22 48	22 51	22 55	22 58	23 01	23 04	23 08	23 10	23 13
23	23 37	23 38	23 38	23 39	23 39	23 39	23 40	23 40	23 40	23 41	23 41	23 41	23 42	23 42
24	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
25	0 43	0 39	0 37	0 34	0 32	0 31	0 28	0 25	0 23	0 20	0 18	0 15	0 13	0 11
26	1 48	1 41	1 35	1 31	1 27	1 23	1 17	1 11	1 06	1 01	0 55	0 49	0 45	0 41
27	2 55	2 44	2 35	2 28	2 22	2 16	2 07	1 58	1 51	1 43	1 34	1 25	1 20	1 13
28	4 02	3 48	3 36	3 26	3 18	3 11	2 58	2 48	2 37	2 27	2 16	2 04	1 57	1 49
29	5 09	4 51	4 37	4 25	4 16	4 07	3 52	3 39	3 27	3 15	3 02	2 47	2 39	2 29
30	6 13	5 53	5 37	5 24	5 13	5 04	4 47	4 33	4 19	4 06	3 51	3 35	3 25	3 14
July 1	7 12	6 51	6 35	6 21	6 10	6 00	5 43	5 28	5 14	5 00	4 45	4 28	4 18	4 06
2	8 04	7 44	7 28	7 16	7 05	6 55	6 39	6 24	6 11	5 57	5 42	5 26	5 16	5 05

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2015
UNIVERSAL TIME FOR MERIDIAN OF GREENWICH
MOONRISE

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Lat.	+40'	+42'	+44'	+46'	+48'	+50'	+52'	+54'	+56'	+58'	+60'	+62'	+64'	+66'
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
June	8	23 52	23 54	23 55	23 57	23 59	0 07	0 15
	9	.. ..	.. ..	.. ..	.. ..	.. ..	0 01	0 03	0 05	0 08	0 11	0 14	0 18	0 27
	10	0 28	0 29	0 29	0 29	0 30	0 30	0 31	0 32	0 32	0 33	0 34	0 35	0 36
	11	1 04	1 03	1 02	1 02	1 01	1 00	0 59	0 57	0 56	0 55	0 53	0 51	0 49
	12	1 41	1 39	1 37	1 35	1 32	1 30	1 27	1 24	1 21	1 17	1 13	1 09	1 03
	13	2 19	2 16	2 13	2 10	2 06	2 02	1 58	1 53	1 48	1 43	1 36	1 29	1 20
	14	3 01	2 57	2 53	2 49	2 44	2 39	2 33	2 27	2 20	2 12	2 03	1 53	1 41
	15	3 47	3 43	3 38	3 32	3 27	3 21	3 14	3 06	2 58	2 48	2 37	2 25	2 10
	16	4 37	4 32	4 27	4 21	4 15	4 08	4 01	3 52	3 43	3 32	3 20	3 06	2 49
	17	5 31	5 26	5 20	5 15	5 08	5 01	4 54	4 45	4 36	4 25	4 13	3 58	3 41
	18	6 27	6 22	6 17	6 12	6 06	5 59	5 52	5 44	5 35	5 25	5 14	5 00	4 44
	19	7 25	7 20	7 16	7 11	7 06	7 00	6 54	6 47	6 39	6 31	6 21	6 09	5 56
	20	8 22	8 19	8 15	8 11	8 07	8 03	7 57	7 52	7 46	7 39	7 31	7 22	7 11
	21	9 19	9 17	9 14	9 11	9 08	9 05	9 01	8 57	8 53	8 48	8 42	8 35	8 28
	22	10 16	10 14	10 13	10 11	10 09	10 07	10 04	10 02	9 59	9 56	9 53	9 49	9 44
	23	11 12	11 11	11 10	11 10	11 09	11 08	11 07	11 06	11 05	11 04	11 03	11 01	11 00
	24	12 07	12 08	12 08	12 09	12 09	12 10	12 10	12 11	12 12	12 12	12 13	12 14	12 15
	25	13 03	13 05	13 06	13 08	13 10	13 11	13 13	13 16	13 18	13 21	13 24	13 27	13 31
	26	14 00	14 03	14 05	14 08	14 11	14 14	14 17	14 21	14 25	14 30	14 35	14 41	14 48
	27	14 58	15 01	15 05	15 09	15 13	15 17	15 22	15 27	15 33	15 40	15 48	15 56	16 06
	28	15 57	16 01	16 06	16 10	16 15	16 21	16 27	16 34	16 41	16 50	17 00	17 11	17 24
	29	16 56	17 01	17 06	17 12	17 18	17 24	17 31	17 39	17 48	17 58	18 09	18 23	18 39
	30	17 55	18 00	18 05	18 11	18 17	18 24	18 32	18 41	18 50	19 01	19 14	19 29	19 47
July	1	18 51	18 56	19 01	19 07	19 13	19 20	19 28	19 36	19 46	19 57	20 09	20 24	20 42
	2	19 43	19 48	19 53	19 58	20 04	20 10	20 17	20 25	20 34	20 43	20 55	21 08	21 23

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
June	8	10 35	10 32	10 30	10 28	10 25	10 22	10 19	10 15	10 12	10 07	10 02	9 57	9 50
	9	11 43	11 42	11 40	11 39	11 38	11 37	11 35	11 34	11 32	11 30	11 28	11 25	11 22
	10	12 51	12 51	12 51	12 51	12 51	12 52	12 52	12 52	12 53	12 53	12 53	12 54	12 55
	11	13 59	14 00	14 01	14 03	14 05	14 07	14 09	14 11	14 13	14 16	14 19	14 23	14 31
	12	15 06	15 09	15 12	15 14	15 18	15 21	15 25	15 29	15 33	15 38	15 44	15 51	16 07
	13	16 13	16 17	16 21	16 25	16 29	16 34	16 39	16 45	16 51	16 59	17 07	17 16	17 28
	14	17 18	17 23	17 27	17 32	17 38	17 44	17 50	17 58	18 06	18 15	18 25	18 37	18 52
	15	18 20	18 25	18 30	18 36	18 42	18 49	18 56	19 04	19 13	19 24	19 36	19 50	20 07
	16	19 17	19 22	19 28	19 33	19 40	19 47	19 54	20 03	20 12	20 23	20 36	20 50	21 08
	17	20 08	20 13	20 18	20 24	20 30	20 37	20 44	20 52	21 01	21 12	21 23	21 37	21 54
	18	20 54	20 58	21 03	21 08	21 13	21 19	21 26	21 33	21 41	21 50	22 00	22 12	22 26
	19	21 34	21 38	21 42	21 46	21 50	21 55	22 01	22 07	22 13	22 21	22 29	22 39	22 50
	20	22 10	22 13	22 16	22 19	22 22	22 26	22 30	22 35	22 40	22 46	22 52	22 59	23 08
	21	22 42	22 44	22 46	22 49	22 51	22 54	22 56	23 00	23 03	23 07	23 11	23 16	23 21
	22	23 13	23 14	23 15	23 16	23 17	23 19	23 20	23 22	23 24	23 25	23 28	23 30	23 33
	23	23 42	23 42	23 42	23 42	23 42	23 42	23 42	23 43	23 43	23 43	23 43	23 43	23 44
	24	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 59	23 57	23 54
	25	0 11	0 10	0 09	0 08	0 07	0 06	0 05	0 03	0 02	0 00	.. ..	.. ..	.. ..
	26	0 41	0 39	0 37	0 35	0 33	0 31	0 28	0 25	0 22	0 19	0 15	0 11	0 05
	27	1 13	1 11	1 08	1 05	1 01	0 58	0 54	0 49	0 45	0 39	0 33	0 27	0 19
	28	1 49	1 45	1 41	1 37	1 33	1 28	1 23	1 17	1 11	1 04	0 55	0 46	0 35
	29	2 29	2 25	2 20	2 15	2 10	2 04	1 57	1 50	1 42	1 33	1 23	1 11	0 58
	30	3 14	3 10	3 04	2 59	2 53	2 46	2 39	2 31	2 22	2 11	1 59	1 46	1 29
July	1	4 06	4 01	3 56	3 50	3 43	3 36	3 29	3 20	3 10	2 59	2 47	2 32	2 14
	2	5 05	5 00	4 54	4 49	4 42	4 35	4 28	4 19	4 10	3 59	3 47	3 32	3 15

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2015
UNIVERSAL TIME FOR MERIDIAN OF GREENWICH
MOONRISE

Lat.	-55°	-50°	-45°	-40°	-35°	-30°	-20°	-10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 1	15 46	16 07	16 23	16 36	16 48	16 58	17 15	17 29	17 43	17 57	18 12	18 29	18 39	18 51
2	16 51	17 10	17 25	17 38	17 48	17 57	18 13	18 27	18 40	18 53	19 07	19 23	19 32	19 43
3	18 03	18 20	18 32	18 43	18 52	19 00	19 14	19 26	19 37	19 48	20 00	20 14	20 22	20 31
4	19 21	19 33	19 43	19 51	19 58	20 04	20 15	20 24	20 33	20 41	20 51	21 01	21 07	21 14
5	20 41	20 49	20 55	21 00	21 05	21 09	21 16	21 22	21 27	21 33	21 39	21 45	21 49	21 54
6	22 02	22 05	22 08	22 10	22 11	22 13	22 16	22 18	22 20	22 23	22 25	22 28	22 29	22 31
7	23 23	23 21	23 19	23 18	23 17	23 16	23 15	23 14	23 12	23 11	23 10	23 09	23 08	23 07
8	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 55	23 50	23 47	23 43
9	0 42	0 35	0 30	0 26	0 22	0 19	0 14	0 09	0 04	0 00	.. ..	.. ..	.. ..	.. ..
10	2 00	1 49	1 40	1 33	1 27	1 21	1 12	1 04	0 56	0 49	0 41	0 32	0 27	0 21
11	3 15	3 00	2 48	2 39	2 30	2 23	2 10	1 59	1 49	1 39	1 28	1 16	1 09	1 01
12	4 26	4 08	3 54	3 42	3 32	3 23	3 08	2 55	2 42	2 30	2 17	2 02	1 54	1 44
13	5 31	5 11	4 55	4 42	4 31	4 21	4 04	3 50	3 36	3 23	3 08	2 52	2 42	2 31
14	6 28	6 07	5 51	5 37	5 26	5 16	4 59	4 44	4 30	4 16	4 01	3 44	3 34	3 23
15	7 16	6 56	6 40	6 27	6 16	6 07	5 50	5 36	5 22	5 09	4 54	4 38	4 28	4 17
16	7 55	7 37	7 23	7 12	7 02	6 53	6 38	6 25	6 13	6 00	5 47	5 32	5 24	5 14
17	8 28	8 13	8 01	7 52	7 43	7 36	7 23	7 12	7 01	6 51	6 40	6 27	6 19	6 11
18	8 55	8 44	8 35	8 27	8 21	8 15	8 05	7 56	7 48	7 40	7 31	7 21	7 15	7 08
19	9 19	9 11	9 05	9 00	8 55	8 51	8 44	8 38	8 33	8 27	8 21	8 14	8 10	8 05
20	9 40	9 36	9 33	9 30	9 28	9 26	9 22	9 19	9 16	9 13	9 10	9 06	9 04	9 02
21	10 00	10 00	9 59	9 59	9 59	9 59	9 59	9 58	9 58	9 58	9 58	9 58	9 57	9 57
22	10 20	10 23	10 26	10 28	10 30	10 32	10 35	10 38	10 40	10 43	10 46	10 49	10 51	10 53
23	10 41	10 48	10 54	10 58	11 03	11 06	11 12	11 18	11 23	11 29	11 34	11 41	11 44	11 49
24	11 05	11 15	11 23	11 31	11 37	11 42	11 51	12 00	12 07	12 15	12 24	12 33	12 39	12 45
25	11 31	11 45	11 56	12 06	12 14	12 21	12 33	12 44	12 54	13 04	13 15	13 27	13 35	13 43

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 1	7 12	6 51	6 35	6 21	6 10	6 00	5 43	5 28	5 14	5 00	4 45	4 28	4 18	4 06
2	8 04	7 44	7 28	7 16	7 05	6 55	6 39	6 24	6 11	5 57	5 42	5 26	5 16	5 05
3	8 48	8 30	8 17	8 06	7 56	7 47	7 33	7 20	7 07	6 55	6 42	6 27	6 18	6 08
4	9 25	9 11	9 00	8 51	8 43	8 36	8 24	8 14	8 04	7 54	7 43	7 31	7 23	7 15
5	9 56	9 46	9 39	9 32	9 27	9 22	9 14	9 06	8 59	8 52	8 44	8 35	8 30	8 24
6	10 23	10 18	10 14	10 11	10 08	10 05	10 01	9 56	9 53	9 49	9 44	9 39	9 37	9 33
7	10 49	10 48	10 48	10 48	10 47	10 47	10 46	10 46	10 45	10 45	10 44	10 43	10 43	10 42
8	11 14	11 18	11 21	11 24	11 26	11 28	11 31	11 34	11 37	11 40	11 43	11 46	11 48	11 51
9	11 40	11 48	11 55	12 00	12 05	12 09	12 17	12 23	12 29	12 35	12 42	12 49	12 53	12 58
10	12 08	12 21	12 31	12 39	12 46	12 52	13 03	13 12	13 21	13 30	13 40	13 51	13 57	14 04
11	12 41	12 57	13 10	13 20	13 29	13 37	13 51	14 03	14 14	14 26	14 38	14 52	15 00	15 09
12	13 19	13 38	13 53	14 06	14 16	14 25	14 41	14 55	15 08	15 21	15 35	15 51	16 00	16 11
13	14 05	14 25	14 42	14 55	15 06	15 16	15 33	15 48	16 02	16 16	16 30	16 47	16 57	17 09
14	14 57	15 18	15 35	15 48	15 59	16 09	16 26	16 41	16 55	17 09	17 24	17 40	17 50	18 01
15	15 56	16 16	16 31	16 44	16 54	17 04	17 20	17 34	17 47	18 00	18 13	18 29	18 38	18 49
16	17 00	17 17	17 30	17 41	17 50	17 59	18 13	18 25	18 36	18 48	19 00	19 14	19 22	19 31
17	18 05	18 19	18 30	18 39	18 46	18 53	19 05	19 15	19 24	19 34	19 43	19 55	20 01	20 09
18	19 11	19 21	19 29	19 36	19 42	19 47	19 55	20 03	20 10	20 17	20 24	20 32	20 37	20 43
19	20 17	20 24	20 28	20 33	20 36	20 39	20 45	20 49	20 54	20 58	21 02	21 08	21 11	21 14
20	21 23	21 25	21 27	21 28	21 30	21 31	21 33	21 35	21 36	21 38	21 40	21 41	21 42	21 44
21	22 28	22 26	22 25	22 24	22 23	22 22	22 21	22 20	22 18	22 17	22 16	22 15	22 14	22 13
22	23 33	23 28	23 23	23 20	23 17	23 14	23 09	23 05	23 01	22 57	22 53	22 48	22 45	22 42
23	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 58	23 51	23 44	23 38	23 31	23 23	23 18	23 13
24	0 38	0 29	0 22	0 16	0 11	0 06	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 54	23 46
25	1 44	1 32	1 21	1 13	1 06	0 59	0 48	0 38	0 29	0 20	0 11	0 00	.. ..	.. ..

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2015

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

49

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 1	18 51	18 56	19 01	19 07	19 13	19 20	19 28	19 36	19 46	19 57	20 09	20 24	20 42	21 04
2	19 43	19 48	19 53	19 58	20 04	20 10	20 17	20 25	20 34	20 43	20 55	21 08	21 23	21 42
3	20 31	20 35	20 39	20 43	20 48	20 54	20 59	21 06	21 13	21 21	21 30	21 41	21 53	22 08
4	21 14	21 17	21 20	21 24	21 27	21 31	21 36	21 41	21 46	21 52	21 59	22 06	22 15	22 25
5	21 54	21 56	21 58	22 00	22 02	22 05	22 08	22 11	22 14	22 18	22 22	22 27	22 32	22 38
6	22 31	22 32	22 33	22 34	22 35	22 36	22 37	22 38	22 39	22 41	22 43	22 44	22 47	22 49
7	23 07	23 07	23 06	23 06	23 06	23 05	23 05	23 04	23 03	23 03	23 02	23 01	23 00	22 59
8	23 43	23 42	23 40	23 39	23 37	23 35	23 33	23 30	23 28	23 25	23 22	23 18	23 14	23 09
9	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 58	23 54	23 49	23 43	23 37	23 29	23 21
10	0 21	0 18	0 16	0 13	0 09	0 06	0 02	.. ..	.. ..	.. ..	.. ..	23 59	23 48	23 36
11	1 01	0 57	0 53	0 49	0 45	0 40	0 35	0 29	0 23	0 16	0 08	.. ..	.. ..	23 57
12	1 44	1 40	1 35	1 30	1 25	1 19	1 13	1 06	0 58	0 49	0 39	0 27	0 13	.. ..
13	2 31	2 26	2 21	2 16	2 10	2 03	1 56	1 48	1 39	1 29	1 17	1 03	0 47	0 27
14	3 23	3 17	3 12	3 06	3 00	2 53	2 45	2 37	2 27	2 17	2 04	1 50	1 32	1 10
15	4 17	4 12	4 07	4 01	3 55	3 48	3 41	3 33	3 23	3 13	3 01	2 47	2 30	2 09
16	5 14	5 09	5 04	4 59	4 54	4 48	4 41	4 33	4 25	4 16	4 05	3 53	3 38	3 20
17	6 11	6 07	6 03	5 59	5 54	5 49	5 44	5 37	5 30	5 23	5 14	5 04	4 52	4 37
18	7 08	7 06	7 02	6 59	6 55	6 51	6 47	6 42	6 37	6 31	6 25	6 17	6 08	5 58
19	8 05	8 03	8 01	7 59	7 56	7 54	7 51	7 48	7 44	7 40	7 36	7 31	7 25	7 18
20	9 02	9 01	8 59	8 58	8 57	8 56	8 54	8 52	8 51	8 49	8 46	8 44	8 41	8 37
21	9 57	9 57	9 57	9 57	9 57	9 57	9 57	9 57	9 57	9 57	9 56	9 56	9 56	9 56
22	10 53	10 54	10 55	10 56	10 57	10 58	11 00	11 01	11 03	11 04	11 07	11 09	11 11	11 15
23	11 49	11 51	11 53	11 55	11 57	12 00	12 02	12 05	12 09	12 13	12 17	12 22	12 27	12 34
24	12 45	12 48	12 51	12 54	12 58	13 02	13 06	13 10	13 16	13 21	13 28	13 35	13 44	13 54
25	13 43	13 47	13 50	13 55	13 59	14 04	14 10	14 16	14 23	14 30	14 39	14 49	15 00	15 14

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 1	4 06	4 01	3 56	3 50	3 43	3 36	3 29	3 20	3 10	2 59	2 47	2 32	2 14	1 51
2	5 05	5 00	4 54	4 49	4 42	4 35	4 28	4 19	4 10	3 59	3 47	3 32	3 15	2 53
3	6 08	6 04	5 59	5 54	5 48	5 42	5 35	5 28	5 19	5 10	4 59	4 46	4 31	4 13
4	7 15	7 12	7 08	7 03	6 59	6 54	6 49	6 43	6 36	6 28	6 20	6 10	5 58	5 45
5	8 24	8 21	8 19	8 16	8 13	8 09	8 05	8 01	7 56	7 51	7 45	7 38	7 31	7 21
6	9 33	9 32	9 30	9 29	9 27	9 25	9 23	9 21	9 18	9 15	9 12	9 09	9 04	8 59
7	10 42	10 42	10 42	10 42	10 41	10 41	10 41	10 40	10 40	10 40	10 39	10 38	10 38	10 37
8	11 51	11 52	11 53	11 54	11 55	11 56	11 58	11 59	12 01	12 03	12 05	12 08	12 10	12 14
9	12 58	13 00	13 02	13 05	13 08	13 10	13 14	13 17	13 21	13 25	13 30	13 35	13 41	13 49
10	14 04	14 08	14 11	14 15	14 19	14 23	14 28	14 33	14 39	14 45	14 52	15 01	15 11	15 22
11	15 09	15 13	15 17	15 22	15 27	15 33	15 39	15 45	15 53	16 01	16 11	16 22	16 35	16 51
12	16 11	16 15	16 20	16 26	16 32	16 38	16 45	16 53	17 02	17 12	17 23	17 37	17 53	18 12
13	17 09	17 14	17 19	17 25	17 31	17 38	17 45	17 54	18 03	18 14	18 26	18 41	18 58	19 20
14	18 01	18 06	18 12	18 17	18 24	18 31	18 38	18 46	18 56	19 06	19 18	19 33	19 50	20 11
15	18 49	18 53	18 58	19 04	19 10	19 16	19 23	19 30	19 39	19 49	20 00	20 12	20 28	20 46
16	19 31	19 35	19 39	19 44	19 49	19 54	20 00	20 07	20 14	20 22	20 32	20 42	20 55	21 10
17	20 09	20 12	20 15	20 19	20 23	20 28	20 32	20 37	20 43	20 50	20 57	21 05	21 15	21 26
18	20 43	20 45	20 48	20 50	20 53	20 56	21 00	21 04	21 08	21 12	21 18	21 24	21 30	21 38
19	21 14	21 15	21 17	21 19	21 20	21 22	21 25	21 27	21 29	21 32	21 35	21 39	21 43	21 48
20	21 44	21 44	21 45	21 45	21 46	21 47	21 47	21 48	21 49	21 50	21 51	21 53	21 54	21 56
21	22 13	22 12	22 12	22 11	22 11	22 10	22 10	22 09	22 08	22 08	22 07	22 06	22 05	22 03
22	22 42	22 41	22 39	22 38	22 36	22 34	22 32	22 30	22 28	22 25	22 22	22 19	22 15	22 11
23	23 13	23 11	23 08	23 06	23 03	23 00	22 57	22 53	22 49	22 45	22 40	22 34	22 28	22 20
24	23 46	23 43	23 40	23 36	23 32	23 28	23 24	23 19	23 13	23 07	23 00	22 52	22 42	22 31
25	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 55	23 48	23 41	23 33	23 24	23 14	23 01	22 47

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2015
UNIVERSAL TIME FOR MERIDIAN OF GREENWICH
MOONRISE

Lat.	-55	-50°	-45°	-40°	-35°	-30°	-20°	-10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 24	11 05	11 15	11 23	11 31	11 37	11 42	11 51	12 00	12 07	12 15	12 24	12 33	12 39	12 45
25	11 31	11 45	11 56	12 06	12 14	12 21	12 33	12 44	12 54	13 04	13 15	13 27	13 35	13 43
26	12 04	12 21	12 34	12 45	12 55	13 03	13 18	13 31	13 43	13 55	14 08	14 22	14 31	14 41
27	12 43	13 02	13 18	13 30	13 41	13 50	14 07	14 21	14 34	14 48	15 02	15 19	15 28	15 39
28	13 32	13 53	14 09	14 22	14 33	14 43	15 00	15 15	15 29	15 43	15 58	16 15	16 25	16 36
29	14 31	14 51	15 07	15 20	15 31	15 41	15 57	16 12	16 25	16 39	16 53	17 10	17 19	17 30
30	15 41	15 58	16 13	16 24	16 34	16 43	16 57	17 10	17 23	17 35	17 48	18 03	18 11	18 21
31	16 58	17 12	17 23	17 32	17 40	17 48	18 00	18 10	18 20	18 30	18 41	18 53	19 00	19 07
Aug. 1	18 19	18 29	18 37	18 43	18 49	18 54	19 02	19 10	19 17	19 24	19 31	19 40	19 45	19 50
2	19 42	19 47	19 51	19 55	19 58	20 00	20 05	20 09	20 12	20 16	20 20	20 24	20 27	20 30
3	21 05	21 06	21 06	21 06	21 06	21 06	21 06	21 06	21 07	21 07	21 07	21 07	21 07	21 08
4	22 27	22 23	22 19	22 16	22 13	22 11	22 07	22 03	22 00	21 57	21 53	21 50	21 47	21 45
5	23 47	23 38	23 31	23 24	23 19	23 15	23 07	23 00	22 53	22 47	22 40	22 32	22 28	22 23
6	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 55	23 46	23 37	23 27	23 16	23 09	23 02
7	1 04	0 51	0 40	0 31	0 24	0 17	0 05	.. ..	.. ..	.. ..	.. ..	.. ..	23 54	23 44
8	2 17	2 00	1 46	1 35	1 26	1 18	1 03	0 51	0 39	0 28	0 16	0 02	.. ..	.. ..
9	3 24	3 04	2 49	2 36	2 25	2 16	2 00	1 46	1 33	1 19	1 06	0 50	0 40	0 30
10	4 22	4 02	3 45	3 32	3 21	3 11	2 54	2 39	2 25	2 12	1 57	1 40	1 30	1 19
11	5 13	4 52	4 36	4 23	4 12	4 02	3 46	3 31	3 17	3 04	2 49	2 32	2 23	2 12
12	5 54	5 36	5 21	5 09	4 59	4 50	4 34	4 21	4 08	3 55	3 42	3 26	3 17	3 07
13	6 29	6 13	6 01	5 50	5 41	5 34	5 20	5 08	4 57	4 46	4 34	4 20	4 12	4 03
14	6 58	6 46	6 36	6 27	6 20	6 14	6 03	5 53	5 44	5 35	5 25	5 14	5 07	5 00
15	7 23	7 14	7 07	7 01	6 55	6 51	6 43	6 36	6 29	6 22	6 15	6 07	6 02	5 57
16	7 45	7 40	7 36	7 32	7 29	7 26	7 21	7 17	7 13	7 09	7 04	6 59	6 57	6 53
17	8 06	8 04	8 03	8 02	8 01	8 00	7 58	7 57	7 55	7 54	7 53	7 51	7 50	7 49

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 24	0 38	0 29	0 22	0 16	0 11	0 06	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 54	23 46
25	1 44	1 32	1 21	1 13	1 06	0 59	0 48	0 38	0 29	0 20	0 11	0 00	.. ..	.. ..
26	2 50	2 34	2 21	2 11	2 02	1 54	1 40	1 28	1 17	1 06	0 54	0 40	0 32	0 24
27	3 55	3 36	3 21	3 09	2 58	2 49	2 34	2 20	2 07	1 54	1 41	1 25	1 16	1 06
28	4 56	4 35	4 19	4 06	3 55	3 45	3 29	3 14	3 00	2 46	2 32	2 15	2 05	1 54
29	5 51	5 31	5 15	5 02	4 51	4 41	4 24	4 09	3 55	3 42	3 27	3 10	3 00	2 48
30	6 40	6 21	6 07	5 54	5 44	5 35	5 19	5 05	4 53	4 40	4 26	4 10	4 00	3 50
31	7 21	7 05	6 53	6 43	6 34	6 26	6 13	6 01	5 50	5 39	5 27	5 13	5 05	4 56
Aug. 1	7 56	7 44	7 35	7 27	7 21	7 15	7 05	6 56	6 47	6 39	6 29	6 19	6 13	6 06
2	8 26	8 19	8 13	8 08	8 04	8 01	7 54	7 49	7 43	7 38	7 32	7 25	7 22	7 17
3	8 53	8 51	8 49	8 47	8 46	8 44	8 42	8 40	8 38	8 36	8 34	8 32	8 30	8 29
4	9 19	9 21	9 23	9 25	9 26	9 27	9 29	9 30	9 32	9 34	9 35	9 37	9 38	9 39
5	9 46	9 52	9 57	10 02	10 06	10 09	10 15	10 20	10 25	10 30	10 35	10 41	10 45	10 49
6	10 14	10 24	10 33	10 40	10 47	10 52	11 02	11 10	11 18	11 26	11 35	11 44	11 50	11 56
7	10 45	11 00	11 12	11 21	11 30	11 37	11 50	12 01	12 11	12 22	12 33	12 46	12 53	13 02
8	11 21	11 39	11 53	12 05	12 15	12 24	12 39	12 52	13 05	13 17	13 30	13 46	13 54	14 05
9	12 04	12 24	12 40	12 53	13 04	13 13	13 30	13 44	13 58	14 11	14 26	14 43	14 52	15 03
10	12 53	13 14	13 30	13 44	13 55	14 05	14 22	14 37	14 51	15 04	15 19	15 36	15 46	15 57
11	13 49	14 09	14 25	14 38	14 49	14 58	15 14	15 29	15 42	15 55	16 09	16 26	16 35	16 46
12	14 50	15 08	15 22	15 34	15 43	15 52	16 07	16 20	16 32	16 44	16 57	17 11	17 20	17 29
13	15 54	16 09	16 21	16 30	16 39	16 46	16 59	17 10	17 20	17 30	17 41	17 53	18 00	18 08
14	17 00	17 11	17 20	17 28	17 34	17 40	17 49	17 58	18 06	18 14	18 22	18 32	18 37	18 43
15	18 05	18 13	18 19	18 24	18 29	18 32	18 39	18 45	18 50	18 56	19 01	19 08	19 11	19 16
16	19 11	19 15	19 18	19 20	19 22	19 24	19 28	19 31	19 33	19 36	19 39	19 42	19 44	19 46
17	20 16	20 16	20 16	20 16	20 16	20 16	20 16	20 16	20 16	20 16	20 16	20 16	20 15	20 15

.. .. indicates phenomenon will occur the next day.

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 24	12 45	12 48	12 51	12 54	12 58	13 02	13 06	13 10	13 16	13 21	13 28	13 35	13 44	13 54
25	13 43	13 47	13 50	13 55	13 59	14 04	14 10	14 16	14 23	14 30	14 39	14 49	15 00	15 14
26	14 41	14 45	14 50	14 55	15 01	15 07	15 13	15 21	15 29	15 38	15 49	16 01	16 16	16 34
27	15 39	15 44	15 49	15 55	16 01	16 08	16 15	16 23	16 33	16 43	16 55	17 09	17 27	17 48
28	16 36	16 41	16 47	16 52	16 59	17 06	17 14	17 22	17 32	17 43	17 55	18 10	18 28	18 50
29	17 30	17 35	17 41	17 46	17 52	17 59	18 06	18 15	18 24	18 34	18 46	19 00	19 17	19 37
30	18 21	18 25	18 30	18 35	18 40	18 46	18 53	19 00	19 08	19 17	19 27	19 39	19 53	20 09
31	19 07	19 11	19 15	19 19	19 23	19 28	19 33	19 38	19 45	19 52	19 59	20 08	20 19	20 31
Aug. 1	19 50	19 53	19 55	19 58	20 01	20 04	20 08	20 12	20 16	20 21	20 26	20 32	20 39	20 47
2	20 30	20 31	20 32	20 34	20 36	20 37	20 39	20 41	20 43	20 46	20 48	20 52	20 55	20 59
3	21 08	21 08	21 08	21 08	21 08	21 08	21 08	21 09	21 09	21 09	21 09	21 09	21 10	21 10
4	21 45	21 44	21 43	21 41	21 40	21 39	21 37	21 35	21 34	21 32	21 29	21 27	21 24	21 20
5	22 23	22 20	22 18	22 16	22 13	22 10	22 07	22 03	22 00	21 55	21 51	21 45	21 39	21 32
6	23 02	22 59	22 56	22 52	22 48	22 44	22 39	22 34	22 28	22 22	22 15	22 07	21 57	21 46
7	23 44	23 40	23 36	23 31	23 26	23 21	23 15	23 08	23 01	22 53	22 43	22 33	22 20	22 05
8	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 56	23 48	23 40	23 30	23 19	23 06	22 50	22 32
9	0 30	0 25	0 20	0 15	0 09	0 03	.. ..	.. ..	.. ..	.. ..	.. ..	23 48	23 31	23 10
10	1 19	1 14	1 09	1 03	0 57	0 50	0 43	0 34	0 25	0 15	0 02	.. ..	.. ..	.. ..
11	2 12	2 07	2 01	1 56	1 50	1 43	1 35	1 27	1 18	1 07	0 55	0 41	0 24	0 02
12	3 07	3 02	2 57	2 52	2 46	2 40	2 33	2 25	2 16	2 07	1 56	1 43	1 27	1 08
13	4 03	3 59	3 55	3 50	3 45	3 40	3 34	3 27	3 20	3 11	3 02	2 51	2 38	2 22
14	5 00	4 57	4 53	4 50	4 46	4 41	4 36	4 31	4 25	4 19	4 11	4 03	3 53	3 41
15	5 57	5 55	5 52	5 49	5 46	5 43	5 40	5 36	5 32	5 27	5 22	5 16	5 09	5 01
16	6 53	6 52	6 50	6 49	6 47	6 45	6 43	6 41	6 38	6 35	6 32	6 29	6 25	6 20
17	7 49	7 49	7 48	7 48	7 47	7 47	7 46	7 45	7 44	7 43	7 43	7 41	7 40	7 39

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 24	23 46	23 43	23 40	23 36	23 32	23 28	23 24	23 19	23 13	23 07	23 00	22 52	22 42	22 31
25	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 55	23 48	23 41	23 33	23 24	23 14	23 01	22 47
26	0 24	0 20	0 15	0 11	0 06	0 01	.. ..	.. ..	.. ..	.. ..	23 55	23 43	23 28	23 09
27	1 06	1 01	0 56	0 51	0 45	0 39	0 32	0 24	0 16	0 06	.. ..	.. ..	.. ..	23 43
28	1 54	1 49	1 43	1 38	1 31	1 24	1 17	1 09	0 59	0 49	0 36	0 22	0 05	.. ..
29	2 48	2 43	2 38	2 32	2 26	2 19	2 11	2 03	1 53	1 42	1 29	1 15	0 57	0 34
30	3 50	3 45	3 40	3 34	3 28	3 22	3 15	3 07	2 58	2 48	2 36	2 22	2 06	1 46
31	4 56	4 52	4 48	4 43	4 38	4 32	4 26	4 19	4 12	4 03	3 54	3 42	3 29	3 13
Aug. 1	6 06	6 03	5 59	5 56	5 52	5 48	5 43	5 38	5 32	5 26	5 19	5 11	5 01	4 50
2	7 17	7 15	7 13	7 11	7 08	7 06	7 03	7 00	6 56	6 52	6 48	6 43	6 37	6 30
3	8 29	8 28	8 27	8 26	8 25	8 24	8 23	8 22	8 21	8 19	8 18	8 16	8 14	8 11
4	9 39	9 40	9 40	9 41	9 42	9 42	9 43	9 44	9 45	9 46	9 47	9 48	9 50	9 51
5	10 49	10 50	10 52	10 54	10 56	10 59	11 01	11 04	11 07	11 10	11 14	11 18	11 23	11 29
6	11 56	11 59	12 02	12 05	12 09	12 13	12 17	12 22	12 27	12 32	12 39	12 46	12 55	13 05
7	13 02	13 06	13 10	13 14	13 19	13 24	13 30	13 36	13 43	13 50	13 59	14 09	14 21	14 36
8	14 05	14 09	14 14	14 19	14 25	14 31	14 37	14 45	14 53	15 03	15 13	15 26	15 41	15 59
9	15 03	15 08	15 13	15 19	15 25	15 32	15 39	15 47	15 57	16 07	16 19	16 33	16 50	17 11
10	15 57	16 02	16 07	16 13	16 19	16 26	16 34	16 42	16 51	17 02	17 14	17 29	17 46	18 07
11	16 46	16 50	16 56	17 01	17 07	17 13	17 21	17 28	17 37	17 47	17 59	18 12	18 28	18 47
12	17 29	17 33	17 38	17 43	17 48	17 54	18 00	18 07	18 15	18 24	18 33	18 45	18 58	19 15
13	18 08	18 12	18 15	18 20	18 24	18 29	18 34	18 40	18 46	18 53	19 01	19 10	19 21	19 33
14	18 43	18 46	18 49	18 52	18 55	18 59	19 03	19 07	19 12	19 17	19 23	19 30	19 38	19 47
15	19 16	19 17	19 19	19 21	19 24	19 26	19 29	19 32	19 35	19 38	19 42	19 47	19 52	19 58
16	19 46	19 47	19 48	19 49	19 50	19 51	19 52	19 54	19 55	19 57	19 59	20 01	20 04	20 06
17	20 15	20 15	20 15	20 15	20 15	20 15	20 15	20 15	20 15	20 15	20 15	20 15	20 14	20 14

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2015
UNIVERSAL TIME FOR MERIDIAN OF GREENWICH
MOONRISE

Lat.	-55°	-50°	-45°	-40°	-35°	-30°	-20°	-10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Aug. 16	7 45	7 40	7 36	7 32	7 29	7 26	7 21	7 17	7 13	7 09	7 04	6 59	6 57	6 53
17	8 06	8 04	8 03	8 02	8 01	8 00	7 58	7 57	7 55	7 54	7 53	7 51	7 50	7 49
18	8 26	8 28	8 30	8 31	8 32	8 33	8 35	8 36	8 37	8 39	8 41	8 42	8 43	8 45
19	8 47	8 52	8 57	9 00	9 04	9 06	9 11	9 16	9 20	9 24	9 29	9 34	9 37	9 40
20	9 09	9 18	9 25	9 31	9 37	9 41	9 49	9 56	10 03	10 10	10 17	10 25	10 30	10 36
21	9 34	9 46	9 56	10 05	10 12	10 18	10 29	10 39	10 48	10 57	11 07	11 18	11 25	11 32
22	10 03	10 19	10 31	10 41	10 50	10 58	11 12	11 23	11 35	11 46	11 58	12 12	12 20	12 29
23	10 38	10 57	11 11	11 23	11 33	11 42	11 57	12 11	12 24	12 36	12 50	13 06	13 15	13 25
24	11 22	11 41	11 57	12 10	12 21	12 31	12 47	13 02	13 15	13 29	13 44	14 01	14 10	14 21
25	12 14	12 35	12 51	13 04	13 15	13 24	13 41	13 56	14 10	14 23	14 38	14 55	15 05	15 16
26	13 17	13 36	13 51	14 04	14 14	14 23	14 39	14 53	15 06	15 19	15 32	15 48	15 57	16 08
27	14 30	14 46	14 59	15 09	15 18	15 26	15 40	15 52	16 03	16 14	16 26	16 39	16 47	16 56
28	15 49	16 01	16 11	16 19	16 26	16 32	16 42	16 51	17 00	17 09	17 18	17 28	17 34	17 41
29	17 13	17 20	17 26	17 31	17 35	17 39	17 46	17 51	17 57	18 02	18 08	18 15	18 18	18 23
30	18 38	18 40	18 43	18 44	18 46	18 47	18 49	18 51	18 53	18 55	18 57	18 59	19 01	19 02
31	20 03	20 01	19 59	19 57	19 56	19 54	19 52	19 50	19 49	19 47	19 45	19 43	19 42	19 41
Sept. 1	21 27	21 20	21 14	21 09	21 05	21 01	20 55	20 49	20 44	20 39	20 34	20 27	20 24	20 20
2	22 48	22 36	22 27	22 19	22 12	22 06	21 56	21 47	21 39	21 31	21 22	21 12	21 07	21 00
3	.. ..	23 49	23 36	23 26	23 17	23 09	22 56	22 45	22 34	22 23	22 12	21 59	21 51	21 43
4	0 05	.. ..	.. ..	.. ..	.. ..	.. ..	23 54	23 41	23 28	23 16	23 02	22 47	22 38	22 28
5	1 15	0 56	0 41	0 29	0 19	0 10	.. ..	.. ..	.. ..	.. ..	23 54	23 37	23 28	23 17
6	2 17	1 57	1 41	1 28	1 16	1 07	0 50	0 35	0 22	0 08	.. ..	.. ..	.. ..	.. ..
7	3 10	2 50	2 34	2 20	2 09	2 00	1 43	1 28	1 14	1 01	0 46	0 29	0 20	0 09
8	3 54	3 35	3 20	3 08	2 57	2 48	2 32	2 18	2 05	1 52	1 38	1 22	1 13	1 03
9	4 31	4 14	4 01	3 50	3 41	3 33	3 18	3 06	2 54	2 43	2 30	2 16	2 08	1 58

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Aug. 16	19 11	19 15	19 18	19 20	19 22	19 24	19 28	19 31	19 33	19 36	19 39	19 42	19 44	19 46
17	20 16	20 16	20 16	20 16	20 16	20 16	20 16	20 16	20 16	20 16	20 16	20 16	20 15	20 15
18	21 21	21 17	21 14	21 11	21 09	21 07	21 04	21 01	20 58	20 55	20 52	20 49	20 47	20 45
19	22 26	22 18	22 12	22 07	22 02	21 59	21 52	21 46	21 41	21 35	21 29	21 23	21 19	21 15
20	23 30	23 19	23 10	23 03	22 56	22 51	22 41	22 32	22 24	22 17	22 08	21 58	21 53	21 47
21	.. ..	.. ..	.. ..	23 59	23 51	23 44	23 31	23 20	23 10	23 00	22 49	22 37	22 30	22 21
22	0 35	0 20	0 09	.. ..	.. ..	.. ..	.. ..	.. ..	23 58	23 46	23 33	23 18	23 10	23 00
23	1 39	1 21	1 07	0 56	0 46	0 37	0 23	0 10	.. ..	.. ..	.. ..	.. ..	23 55	23 44
24	2 40	2 20	2 05	1 52	1 41	1 32	1 16	1 02	0 48	0 35	0 21	0 05	.. ..	.. ..
25	3 37	3 17	3 01	2 47	2 36	2 26	2 10	1 55	1 41	1 27	1 13	0 56	0 46	0 34
26	4 28	4 08	3 53	3 40	3 30	3 20	3 04	2 50	2 36	2 23	2 08	1 52	1 42	1 31
27	5 12	4 55	4 42	4 30	4 21	4 12	3 58	3 45	3 33	3 21	3 08	2 53	2 44	2 34
28	5 50	5 37	5 26	5 17	5 09	5 02	4 50	4 40	4 30	4 20	4 09	3 57	3 50	3 42
29	6 23	6 14	6 06	6 00	5 55	5 50	5 41	5 34	5 27	5 20	5 12	5 04	4 59	4 53
30	6 52	6 48	6 44	6 41	6 38	6 35	6 31	6 27	6 24	6 20	6 16	6 11	6 09	6 06
31	7 20	7 20	7 20	7 20	7 20	7 20	7 20	7 20	7 20	7 19	7 19	7 19	7 19	7 19
Sept. 1	7 47	7 52	7 55	7 59	8 01	8 04	8 08	8 12	8 15	8 18	8 22	8 26	8 29	8 31
2	8 16	8 25	8 32	8 38	8 43	8 48	8 56	9 03	9 10	9 17	9 24	9 32	9 37	9 42
3	8 47	9 00	9 11	9 19	9 27	9 34	9 45	9 56	10 05	10 15	10 25	10 37	10 43	10 51
4	9 22	9 39	9 52	10 03	10 13	10 21	10 35	10 48	11 00	11 12	11 24	11 38	11 47	11 56
5	10 03	10 23	10 38	10 51	11 01	11 11	11 27	11 41	11 54	12 07	12 21	12 37	12 47	12 57
6	10 51	11 12	11 28	11 41	11 52	12 02	12 19	12 33	12 47	13 01	13 16	13 32	13 42	13 53
7	11 45	12 05	12 21	12 34	12 45	12 55	13 11	13 26	13 39	13 53	14 07	14 23	14 33	14 44
8	12 44	13 02	13 17	13 29	13 39	13 48	14 03	14 17	14 29	14 42	14 55	15 10	15 19	15 28
9	13 47	14 02	14 15	14 25	14 34	14 42	14 55	15 06	15 17	15 28	15 39	15 52	16 00	16 09

.. .. indicates phenomenon will occur the next day.

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH
 MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Aug. 16	6 53	6 52	6 50	6 49	6 47	6 45	6 43	6 41	6 38	6 35	6 32	6 29	6 25	6 20
17	7 49	7 49	7 48	7 48	7 47	7 47	7 46	7 45	7 44	7 43	7 43	7 41	7 40	7 39
18	8 45	8 45	8 46	8 46	8 47	8 48	8 48	8 49	8 50	8 51	8 52	8 54	8 55	8 57
19	9 40	9 42	9 43	9 45	9 47	9 49	9 51	9 53	9 56	9 59	10 02	10 06	10 10	10 15
20	10 36	10 38	10 41	10 44	10 47	10 50	10 53	10 57	11 02	11 06	11 12	11 18	11 25	11 34
21	11 32	11 35	11 39	11 43	11 47	11 51	11 56	12 01	12 07	12 14	12 22	12 31	12 41	12 53
22	12 29	12 33	12 37	12 42	12 47	12 52	12 58	13 05	13 13	13 21	13 31	13 42	13 55	14 11
23	13 25	13 30	13 35	13 40	13 46	13 53	14 00	14 07	14 16	14 26	14 37	14 51	15 06	15 26
24	14 21	14 26	14 32	14 38	14 44	14 51	14 58	15 07	15 16	15 27	15 39	15 54	16 11	16 33
25	15 16	15 21	15 26	15 32	15 38	15 45	15 53	16 01	16 10	16 21	16 33	16 48	17 05	17 26
26	16 08	16 12	16 17	16 22	16 28	16 35	16 42	16 49	16 58	17 07	17 18	17 31	17 47	18 05
27	16 56	17 00	17 04	17 09	17 13	17 19	17 25	17 31	17 38	17 46	17 55	18 06	18 18	18 32
28	17 41	17 44	17 47	17 50	17 54	17 58	18 02	18 07	18 12	18 18	18 25	18 32	18 41	18 51
29	18 23	18 24	18 26	18 29	18 31	18 33	18 36	18 39	18 42	18 46	18 50	18 54	19 00	19 06
30	19 02	19 03	19 04	19 04	19 05	19 06	19 07	19 08	19 09	19 11	19 12	19 14	19 16	19 18
31	19 41	19 41	19 40	19 39	19 39	19 38	19 37	19 36	19 35	19 34	19 33	19 32	19 31	19 29
Sept. 1	20 20	20 18	20 16	20 15	20 12	20 10	20 08	20 05	20 02	19 59	19 55	19 51	19 46	19 41
2	21 00	20 57	20 54	20 51	20 48	20 44	20 40	20 36	20 31	20 25	20 19	20 12	20 04	19 55
3	21 43	21 39	21 35	21 31	21 26	21 21	21 16	21 10	21 03	20 55	20 47	20 37	20 26	20 12
4	22 28	22 24	22 19	22 14	22 08	22 02	21 56	21 48	21 40	21 31	21 21	21 08	20 54	20 37
5	23 17	23 12	23 07	23 01	22 55	22 48	22 41	22 33	22 24	22 14	22 02	21 48	21 32	21 11
6	.. ..	.. ..	23 58	23 53	23 46	23 40	23 32	23 24	23 15	23 04	22 52	22 38	22 21	21 59
7	0 09	0 04	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 50	23 36	23 20	23 01
8	1 03	0 58	0 53	0 47	0 41	0 35	0 28	0 20	0 11	0 01	.. ..	.. ..	.. ..	.. ..
9	1 58	1 54	1 49	1 45	1 39	1 34	1 27	1 20	1 13	1 04	0 54	0 42	0 29	0 12

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Aug. 16	19 46	19 47	19 48	19 49	19 50	19 51	19 52	19 54	19 55	19 57	19 59	20 01	20 04	20 06	
17	20 15	20 15	20 15	20 15	20 15	20 15	20 15	20 15	20 15	20 15	20 15	20 15	20 14	20 14	
18	20 45	20 44	20 42	20 41	20 40	20 39	20 37	20 36	20 34	20 32	20 30	20 28	20 25	20 22	
19	21 15	21 13	21 11	21 09	21 06	21 04	21 01	20 58	20 55	20 51	20 47	20 42	20 37	20 31	
20	21 47	21 44	21 41	21 38	21 34	21 31	21 26	21 22	21 17	21 12	21 06	20 59	20 51	20 41	
21	22 21	22 18	22 14	22 10	22 05	22 01	21 55	21 49	21 43	21 36	21 28	21 18	21 07	20 55	
22	23 00	22 56	22 51	22 46	22 41	22 35	22 29	22 22	22 14	22 05	21 55	21 44	21 30	21 13	
23	23 44	23 40	23 34	23 29	23 23	23 16	23 09	23 01	22 52	22 42	22 31	22 17	22 01	21 41	
24	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 57	23 49	23 40	23 29	23 16	23 02	22 44	22 22	
25	0 34	0 29	0 24	0 18	0 12	0 05	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 43	23 22	
26	1 31	1 26	1 21	1 15	1 09	1 02	0 55	0 47	0 37	0 27	0 15	0 00	.. ..	.. ..
27	2 34	2 30	2 25	2 20	2 14	2 08	2 01	1 54	1 46	1 36	1 26	1 13	0 58	0 40	
28	3 42	3 38	3 34	3 30	3 26	3 21	3 15	3 09	3 03	2 55	2 47	2 37	2 26	2 12	
29	4 53	4 50	4 48	4 45	4 42	4 38	4 34	4 30	4 26	4 20	4 15	4 08	4 00	3 51	
30	6 06	6 04	6 03	6 01	6 00	5 58	5 56	5 54	5 51	5 49	5 46	5 42	5 38	5 34	
31	7 19	7 19	7 19	7 19	7 19	7 18	7 18	7 18	7 18	7 18	7 18	7 18	7 17	7 17	
Sept. 1	8 31	8 33	8 34	8 35	8 37	8 38	8 40	8 42	8 44	8 46	8 49	8 52	8 55	8 59	
2	9 42	9 45	9 47	9 50	9 53	9 56	10 00	10 03	10 08	10 12	10 18	10 24	10 31	10 39	
3	10 51	10 54	10 58	11 02	11 06	11 11	11 16	11 22	11 28	11 35	11 43	11 52	12 02	12 15	
4	11 56	12 01	12 05	12 10	12 15	12 21	12 27	12 34	12 42	12 51	13 01	13 13	13 27	13 44	
5	12 57	13 02	13 07	13 13	13 19	13 25	13 32	13 40	13 49	13 59	14 11	14 25	14 41	15 01	
6	13 53	13 58	14 04	14 09	14 15	14 22	14 30	14 38	14 47	14 58	15 10	15 24	15 41	16 03	
7	14 44	14 48	14 54	14 59	15 05	15 12	15 19	15 27	15 36	15 46	15 58	16 11	16 28	16 48	
8	15 28	15 33	15 38	15 43	15 48	15 54	16 01	16 08	16 16	16 25	16 35	16 47	17 02	17 19	
9	16 09	16 12	16 16	16 21	16 25	16 30	16 36	16 42	16 49	16 56	17 05	17 15	17 26	17 40	

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2015
UNIVERSAL TIME FOR MERIDIAN OF GREENWICH
MOONRISE

Lat.	-55°	-50°	-45°	-40°	-35°	-30°	-20°	-10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Sept. 8	3 54	3 35	3 20	3 08	2 57	2 48	2 32	2 18	2 05	1 52	1 38	1 22	1 13	1 03
9	4 31	4 14	4 01	3 50	3 41	3 33	3 18	3 06	2 54	2 43	2 30	2 16	2 08	1 58
10	5 01	4 48	4 37	4 28	4 20	4 13	4 02	3 51	3 41	3 32	3 21	3 09	3 02	2 55
11	5 28	5 17	5 09	5 02	4 56	4 51	4 42	4 34	4 27	4 19	4 11	4 02	3 57	3 51
12	5 51	5 44	5 39	5 34	5 30	5 27	5 21	5 16	5 11	5 06	5 00	4 54	4 51	4 47
13	6 12	6 09	6 06	6 04	6 02	6 01	5 58	5 56	5 54	5 51	5 49	5 46	5 45	5 43
14	6 32	6 33	6 33	6 34	6 34	6 34	6 35	6 35	6 36	6 36	6 37	6 38	6 38	6 38
15	6 53	6 57	7 00	7 03	7 06	7 08	7 12	7 15	7 18	7 21	7 25	7 29	7 31	7 34
16	7 14	7 22	7 28	7 33	7 38	7 42	7 49	7 55	8 01	8 07	8 13	8 20	8 25	8 29
17	7 38	7 49	7 58	8 06	8 12	8 18	8 28	8 37	8 45	8 53	9 02	9 12	9 18	9 25
18	8 05	8 20	8 31	8 41	8 49	8 56	9 09	9 20	9 31	9 41	9 52	10 05	10 13	10 21
19	8 38	8 55	9 09	9 20	9 30	9 38	9 53	10 06	10 18	10 30	10 43	10 58	11 07	11 17
20	9 17	9 36	9 51	10 04	10 14	10 24	10 40	10 54	11 07	11 21	11 35	11 51	12 01	12 12
21	10 04	10 24	10 40	10 53	11 04	11 14	11 31	11 45	11 59	12 13	12 27	12 44	12 54	13 05
22	11 01	11 20	11 36	11 48	11 59	12 09	12 25	12 39	12 52	13 06	13 20	13 36	13 46	13 57
23	12 07	12 24	12 38	12 49	12 59	13 08	13 22	13 35	13 47	13 59	14 12	14 27	14 35	14 45
24	13 20	13 35	13 46	13 55	14 03	14 10	14 22	14 33	14 43	14 53	15 03	15 15	15 22	15 30
25	14 40	14 50	14 58	15 05	15 10	15 15	15 24	15 32	15 39	15 46	15 53	16 02	16 07	16 12
26	16 04	16 09	16 13	16 17	16 20	16 22	16 27	16 31	16 35	16 39	16 43	16 47	16 50	16 53
27	17 30	17 30	17 30	17 30	17 30	17 30	17 31	17 31	17 31	17 31	17 32	17 32	17 32	17 32
28	18 56	18 51	18 47	18 44	18 41	18 39	18 35	18 31	18 27	18 24	18 21	18 17	18 14	18 12
29	20 21	20 11	20 03	19 57	19 51	19 47	19 38	19 31	19 24	19 17	19 10	19 02	18 58	18 52
30	21 43	21 29	21 17	21 08	21 00	20 53	20 41	20 31	20 21	20 11	20 01	19 50	19 43	19 35
Oct. 1	22 59	22 41	22 27	22 16	22 06	21 57	21 42	21 30	21 18	21 06	20 53	20 39	20 31	20 21
2	.. ..	23 47	23 31	23 18	23 07	22 58	22 41	22 27	22 14	22 01	21 46	21 30	21 21	21 10

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Sept. 8	12 44	13 02	13 17	13 29	13 39	13 48	14 03	14 17	14 29	14 42	14 55	15 10	15 19	15 28
9	13 47	14 02	14 15	14 25	14 34	14 42	14 55	15 06	15 17	15 28	15 39	15 52	16 00	16 09
10	14 51	15 03	15 13	15 22	15 29	15 35	15 46	15 55	16 04	16 12	16 21	16 32	16 38	16 45
11	15 56	16 05	16 12	16 18	16 23	16 28	16 35	16 42	16 48	16 54	17 01	17 08	17 13	17 18
12	17 01	17 06	17 11	17 14	17 17	17 20	17 24	17 28	17 31	17 35	17 39	17 43	17 46	17 48
13	18 06	18 08	18 09	18 10	18 10	18 11	18 12	18 13	18 14	18 15	18 16	18 17	18 17	18 18
14	19 11	19 09	19 07	19 05	19 04	19 02	19 00	18 58	18 56	18 54	18 52	18 50	18 49	18 47
15	20 16	20 10	20 05	20 01	19 57	19 54	19 48	19 43	19 39	19 34	19 29	19 24	19 21	19 17
16	21 21	21 11	21 03	20 56	20 50	20 45	20 37	20 29	20 22	20 15	20 07	19 59	19 54	19 48
17	22 25	22 12	22 01	21 52	21 44	21 38	21 26	21 16	21 07	20 57	20 47	20 36	20 29	20 22
18	23 28	23 12	22 59	22 48	22 39	22 31	22 17	22 04	21 53	21 42	21 30	21 16	21 08	20 59
19	.. ..	.. ..	23 55	23 43	23 33	23 24	23 08	22 54	22 41	22 29	22 15	21 59	21 50	21 40
20	0 29	0 10	.. ..	.. ..	.. ..	.. ..	.. ..	23 46	23 32	23 18	23 04	22 47	22 37	22 26
21	1 26	1 06	0 50	0 37	0 26	0 17	0 00	.. ..	.. ..	.. ..	23 56	23 39	23 30	23 19
22	2 18	1 58	1 43	1 30	1 19	1 09	0 53	0 38	0 24	0 11	.. ..	.. ..	.. ..	.. ..
23	3 04	2 46	2 31	2 19	2 09	2 00	1 45	1 31	1 18	1 06	0 52	0 36	0 27	0 17
24	3 44	3 28	3 16	3 06	2 57	2 50	2 36	2 25	2 14	2 03	1 51	1 37	1 29	1 20
25	4 18	4 07	3 57	3 50	3 43	3 37	3 27	3 18	3 09	3 01	2 52	2 41	2 35	2 28
26	4 49	4 42	4 36	4 31	4 27	4 23	4 17	4 11	4 05	4 00	3 54	3 47	3 43	3 39
27	5 17	5 15	5 13	5 11	5 09	5 08	5 06	5 03	5 01	4 59	4 57	4 55	4 53	4 51
28	5 45	5 47	5 49	5 50	5 51	5 52	5 54	5 56	5 58	5 59	6 01	6 03	6 04	6 05
29	6 13	6 20	6 25	6 30	6 34	6 38	6 44	6 49	6 54	6 59	7 05	7 11	7 15	7 19
30	6 44	6 55	7 04	7 12	7 18	7 24	7 34	7 43	7 51	7 59	8 08	8 18	8 24	8 31
Oct. 1	7 18	7 34	7 46	7 56	8 05	8 12	8 26	8 37	8 48	8 59	9 11	9 24	9 32	9 40
2	7 59	8 17	8 32	8 44	8 54	9 03	9 18	9 32	9 45	9 57	10 11	10 26	10 35	10 46

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2015

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

55

Lat.	+40°	+42°	+44	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Sept. 8	1 03	0 58	0 53	0 47	0 41	0 35	0 28	0 20	0 11	0 01	.. ..	.. ..	.. ..	.. ..
9	1 58	1 54	1 49	1 45	1 39	1 34	1 27	1 20	1 13	1 04	0 54	0 42	0 29	0 12
10	2 55	2 51	2 47	2 43	2 39	2 34	2 29	2 23	2 17	2 10	2 02	1 52	1 41	1 28
11	3 51	3 48	3 45	3 42	3 39	3 35	3 32	3 27	3 23	3 17	3 11	3 04	2 56	2 47
12	4 47	4 45	4 43	4 41	4 39	4 37	4 34	4 32	4 29	4 25	4 21	4 17	4 12	4 06
13	5 43	5 42	5 41	5 40	5 39	5 38	5 37	5 36	5 35	5 33	5 31	5 29	5 27	5 25
14	6 38	6 39	6 39	6 39	6 39	6 39	6 40	6 40	6 40	6 41	6 41	6 42	6 42	6 43
15	7 34	7 35	7 36	7 37	7 39	7 40	7 42	7 44	7 46	7 48	7 51	7 54	7 57	8 01
16	8 29	8 31	8 34	8 36	8 39	8 41	8 45	8 48	8 52	8 56	9 01	9 06	9 12	9 19
17	9 25	9 28	9 31	9 35	9 38	9 42	9 47	9 52	9 57	10 03	10 10	10 18	10 27	10 38
18	10 21	10 25	10 29	10 33	10 38	10 43	10 49	10 55	11 02	11 10	11 19	11 29	11 41	11 55
19	11 17	11 21	11 26	11 31	11 37	11 43	11 49	11 57	12 05	12 14	12 25	12 38	12 52	13 10
20	12 12	12 17	12 22	12 28	12 34	12 40	12 48	12 56	13 05	13 15	13 27	13 41	13 58	14 19
21	13 05	13 10	13 16	13 22	13 28	13 35	13 42	13 51	14 00	14 11	14 23	14 38	14 55	15 17
22	13 57	14 01	14 07	14 12	14 18	14 25	14 32	14 40	14 49	14 59	15 11	15 24	15 40	16 00
23	14 45	14 49	14 54	14 59	15 04	15 10	15 16	15 23	15 31	15 40	15 50	16 01	16 15	16 32
24	15 30	15 34	15 37	15 41	15 46	15 50	15 55	16 01	16 07	16 14	16 22	16 31	16 41	16 54
25	16 12	16 15	16 18	16 20	16 23	16 27	16 30	16 34	16 39	16 43	16 49	16 55	17 02	17 10
26	16 53	16 54	16 56	16 57	16 59	17 01	17 02	17 04	17 07	17 09	17 12	17 15	17 19	17 23
27	17 32	17 32	17 33	17 33	17 33	17 33	17 33	17 33	17 33	17 34	17 34	17 34	17 35	17 35
28	18 12	18 11	18 10	18 08	18 07	18 05	18 04	18 02	18 00	17 58	17 56	17 53	17 50	17 47
29	18 52	18 50	18 48	18 45	18 42	18 39	18 36	18 32	18 28	18 24	18 19	18 14	18 07	18 00
30	19 35	19 32	19 28	19 25	19 21	19 16	19 11	19 06	19 00	18 53	18 46	18 37	18 28	18 16
Oct. 1	20 21	20 17	20 13	20 08	20 03	19 57	19 51	19 44	19 36	19 28	19 18	19 07	18 54	18 38
2	21 10	21 06	21 00	20 55	20 49	20 43	20 36	20 28	20 19	20 09	19 58	19 44	19 29	19 09

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Sept. 8	15 28	15 33	15 38	15 43	15 48	15 54	16 01	16 08	16 16	16 25	16 35	16 47	17 02	17 19
9	16 09	16 12	16 16	16 21	16 25	16 30	16 36	16 42	16 49	16 56	17 05	17 15	17 26	17 40
10	16 45	16 48	16 51	16 54	16 58	17 02	17 06	17 11	17 16	17 22	17 29	17 36	17 45	17 55
11	17 18	17 20	17 22	17 24	17 27	17 30	17 33	17 36	17 40	17 44	17 49	17 54	18 00	18 07
12	17 48	17 50	17 51	17 52	17 54	17 55	17 57	17 59	18 01	18 03	18 06	18 09	18 12	18 16
13	18 18	18 18	18 19	18 19	18 19	18 20	18 20	18 21	18 21	18 22	18 22	18 23	18 24	18 24
14	18 47	18 47	18 46	18 45	18 44	18 44	18 43	18 42	18 41	18 39	18 38	18 36	18 35	18 32
15	19 17	19 16	19 14	19 12	19 10	19 08	19 06	19 03	19 01	18 58	18 54	18 50	18 46	18 41
16	19 48	19 46	19 43	19 40	19 37	19 34	19 31	19 27	19 22	19 17	19 12	19 06	18 59	18 51
17	20 22	20 19	20 15	20 11	20 07	20 03	19 58	19 53	19 47	19 40	19 33	19 24	19 15	19 03
18	20 59	20 55	20 50	20 46	20 41	20 35	20 29	20 23	20 15	20 07	19 58	19 47	19 35	19 19
19	21 40	21 35	21 30	21 25	21 19	21 13	21 06	20 59	20 50	20 40	20 29	20 17	20 02	19 43
20	22 26	22 21	22 16	22 10	22 04	21 57	21 50	21 42	21 32	21 22	21 10	20 56	20 39	20 18
21	23 19	23 14	23 08	23 02	22 56	22 49	22 42	22 33	22 24	22 13	22 01	21 47	21 29	21 08
22	.. ..	.. ..	.. ..	.. ..	23 56	23 49	23 42	23 34	23 26	23 16	23 04	22 51	22 35	22 15
23	0 17	0 12	0 07	0 01	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 54	23 38
24	1 20	1 16	1 12	1 07	1 02	0 56	0 50	0 44	0 36	0 28	0 18	0 07	.. ..	.. ..
25	2 28	2 25	2 21	2 18	2 14	2 10	2 05	2 00	1 54	1 48	1 41	1 33	1 23	1 12
26	3 39	3 37	3 35	3 32	3 30	3 27	3 24	3 21	3 17	3 13	3 09	3 04	2 58	2 51
27	4 51	4 51	4 50	4 49	4 48	4 47	4 46	4 45	4 43	4 42	4 40	4 38	4 36	4 34
28	6 05	6 06	6 06	6 07	6 08	6 08	6 09	6 10	6 11	6 12	6 13	6 14	6 16	6 18
29	7 19	7 20	7 22	7 24	7 27	7 29	7 32	7 35	7 38	7 41	7 45	7 50	7 55	8 01
30	8 31	8 34	8 37	8 40	8 44	8 48	8 52	8 57	9 02	9 08	9 15	9 23	9 32	9 42
Oct. 1	9 40	9 44	9 49	9 53	9 58	10 03	10 09	10 15	10 23	10 31	10 40	10 51	11 03	11 18
2	10 46	10 50	10 55	11 01	11 06	11 13	11 19	11 27	11 36	11 45	11 56	12 09	12 25	12 44

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2015
UNIVERSAL TIME FOR MERIDIAN OF GREENWICH
MOONRISE

Lat.	-55°	-50°	-45°	-40°	-35°	-30°	-20°	-10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 1	22 59	22 41	22 27	22 16	22 06	21 57	21 42	21 30	21 18	21 06	20 53	20 39	20 31	20 21
2	.. ..	23 47	23 31	23 18	23 07	22 58	22 41	22 27	22 14	22 01	21 46	21 30	21 21	21 10
3	0 07	.. ..	.. ..	.. ..	.. ..	23 54	23 37	23 22	23 08	22 55	22 40	22 23	22 13	22 02
4	1 05	0 44	0 28	0 15	0 04	.. ..	.. ..	.. ..	.. ..	23 48	23 33	23 17	23 08	22 57
5	1 53	1 33	1 18	1 05	0 54	0 45	0 29	0 14	0 01	.. ..	.. ..	.. ..	.. ..	23 53
6	2 32	2 15	2 01	1 50	1 40	1 31	1 16	1 03	0 51	0 39	0 26	0 11	0 03	.. ..
7	3 05	2 50	2 39	2 29	2 21	2 13	2 01	1 50	1 39	1 29	1 18	1 05	0 58	0 49
8	3 32	3 21	3 12	3 04	2 58	2 52	2 42	2 33	2 25	2 17	2 08	1 58	1 52	1 46
9	3 56	3 48	3 42	3 37	3 32	3 28	3 21	3 15	3 09	3 03	2 57	2 50	2 46	2 42
10	4 18	4 13	4 10	4 07	4 05	4 02	3 59	3 55	3 52	3 49	3 46	3 42	3 40	3 37
11	4 38	4 37	4 37	4 37	4 36	4 36	4 35	4 35	4 35	4 34	4 34	4 33	4 33	4 33
12	4 58	5 01	5 04	5 06	5 08	5 09	5 12	5 14	5 17	5 19	5 22	5 25	5 26	5 28
13	5 20	5 26	5 31	5 36	5 40	5 43	5 49	5 55	6 00	6 05	6 10	6 16	6 20	6 24
14	5 43	5 53	6 01	6 08	6 14	6 19	6 28	6 36	6 43	6 51	6 59	7 08	7 14	7 20
15	6 09	6 22	6 33	6 42	6 50	6 56	7 08	7 19	7 29	7 38	7 49	8 01	8 08	8 16
16	6 39	6 56	7 09	7 20	7 29	7 37	7 51	8 04	8 15	8 27	8 40	8 54	9 02	9 12
17	7 16	7 34	7 49	8 02	8 12	8 21	8 37	8 51	9 04	9 17	9 31	9 47	9 56	10 07
18	7 59	8 20	8 35	8 48	8 59	9 09	9 26	9 41	9 54	10 08	10 23	10 39	10 49	11 01
19	8 52	9 12	9 28	9 41	9 52	10 01	10 18	10 32	10 46	10 59	11 14	11 31	11 40	11 51
20	9 52	10 11	10 26	10 38	10 48	10 57	11 12	11 26	11 39	11 51	12 05	12 20	12 29	12 39
21	11 01	11 17	11 29	11 39	11 48	11 56	12 09	12 21	12 32	12 43	12 54	13 08	13 15	13 24
22	12 16	12 27	12 37	12 45	12 52	12 58	13 08	13 17	13 26	13 34	13 43	13 53	13 59	14 06
23	13 35	13 42	13 48	13 53	13 58	14 02	14 08	14 14	14 20	14 25	14 31	14 37	14 41	14 46
24	14 57	15 00	15 02	15 04	15 06	15 07	15 10	15 12	15 14	15 16	15 18	15 21	15 22	15 24
25	16 22	16 19	16 18	16 16	16 15	16 14	16 12	16 10	16 09	16 08	16 06	16 04	16 03	16 02

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 1	7 18	7 34	7 46	7 56	8 05	8 12	8 26	8 37	8 48	8 59	9 11	9 24	9 32	9 40
2	7 59	8 17	8 32	8 44	8 54	9 03	9 18	9 32	9 45	9 57	10 11	10 26	10 35	10 46
3	8 45	9 05	9 21	9 34	9 45	9 55	10 12	10 26	10 40	10 54	11 08	11 25	11 35	11 46
4	9 38	9 59	10 15	10 28	10 39	10 49	11 06	11 20	11 34	11 48	12 02	12 19	12 28	12 39
5	10 37	10 56	11 11	11 23	11 34	11 43	11 59	12 13	12 25	12 38	12 52	13 07	13 16	13 27
6	11 39	11 56	12 09	12 20	12 29	12 37	12 51	13 03	13 15	13 26	13 38	13 52	14 00	14 09
7	12 43	12 57	13 07	13 16	13 24	13 31	13 42	13 52	14 02	14 11	14 21	14 32	14 39	14 46
8	13 48	13 58	14 06	14 13	14 18	14 23	14 32	14 40	14 47	14 54	15 01	15 09	15 14	15 20
9	14 53	14 59	15 04	15 08	15 12	15 15	15 21	15 26	15 30	15 35	15 39	15 45	15 48	15 51
10	15 58	16 00	16 02	16 04	16 06	16 07	16 09	16 11	16 13	16 14	16 16	16 18	16 20	16 21
11	17 03	17 01	17 00	16 59	16 59	16 58	16 57	16 56	16 55	16 54	16 53	16 52	16 51	16 50
12	18 08	18 03	17 58	17 55	17 52	17 50	17 45	17 41	17 37	17 34	17 30	17 25	17 23	17 20
13	19 13	19 04	18 57	18 51	18 46	18 41	18 34	18 27	18 21	18 14	18 08	18 00	17 56	17 51
14	20 17	20 05	19 55	19 47	19 40	19 34	19 23	19 14	19 05	18 56	18 47	18 36	18 30	18 23
15	21 21	21 06	20 53	20 43	20 34	20 26	20 13	20 02	19 51	19 40	19 29	19 15	19 08	18 59
16	22 23	22 05	21 50	21 38	21 28	21 20	21 04	20 51	20 39	20 26	20 13	19 58	19 49	19 39
17	23 21	23 01	22 46	22 33	22 22	22 12	21 56	21 41	21 28	21 14	21 00	20 44	20 34	20 23
18	.. ..	23 54	23 38	23 25	23 14	23 04	22 47	22 33	22 19	22 05	21 50	21 34	21 24	21 12
19	0 14	.. ..	.. ..	.. ..	.. ..	23 54	23 38	23 24	23 11	22 58	22 44	22 27	22 18	22 07
20	1 01	0 42	0 27	0 14	0 04	.. ..	.. ..	.. ..	.. ..	23 52	23 39	23 25	23 16	23 06
21	1 41	1 23	1 12	1 01	0 51	0 43	0 28	0 16	0 04	.. ..	.. ..	.. ..	.. ..	.. ..
22	2 16	2 03	1 53	1 44	1 36	1 29	1 18	1 07	0 57	0 48	0 37	0 25	0 18	0 10
23	2 47	2 38	2 30	2 24	2 19	2 14	2 06	1 58	1 51	1 44	1 37	1 28	1 23	1 17
24	3 15	3 10	3 06	3 03	3 00	2 58	2 53	2 49	2 45	2 41	2 37	2 33	2 30	2 27
25	3 42	3 42	3 42	3 41	3 41	3 41	3 41	3 40	3 40	3 40	3 39	3 39	3 38	3 38

.. .. indicates phenomenon will occur the next day.

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 1	20 21	20 17	20 13	20 08	20 03	19 57	19 51	19 44	19 36	19 28	19 18	19 07	18 54	18 38
2	21 10	21 06	21 00	20 55	20 49	20 43	20 36	20 28	20 19	20 09	19 58	19 44	19 29	19 09
3	22 02	21 57	21 52	21 46	21 40	21 33	21 26	21 18	21 08	20 58	20 46	20 32	20 15	19 53
4	22 57	22 52	22 47	22 41	22 35	22 29	22 21	22 13	22 04	21 54	21 42	21 28	21 12	20 52
5	23 53	23 48	23 44	23 39	23 33	23 27	23 21	23 13	23 05	22 56	22 45	22 32	22 19	22 01
6	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 52	23 42	23 31	23 16
7	0 49	0 45	0 41	0 37	0 32	0 27	0 22	0 16	0 09	0 01	.. ..	.. ..	.. ..	.. ..
8	1 46	1 43	1 39	1 36	1 32	1 29	1 24	1 19	1 14	1 08	1 02	0 54	0 45	0 35
9	2 42	2 40	2 37	2 35	2 33	2 30	2 27	2 24	2 20	2 16	2 11	2 06	2 00	1 53
10	3 37	3 36	3 35	3 34	3 32	3 31	3 29	3 28	3 26	3 24	3 21	3 18	3 15	3 12
11	4 33	4 33	4 32	4 32	4 32	4 32	4 32	4 32	4 31	4 31	4 31	4 31	4 30	4 30
12	5 28	5 29	5 30	5 31	5 32	5 33	5 34	5 36	5 37	5 39	5 41	5 43	5 45	5 48
13	6 24	6 26	6 28	6 30	6 32	6 34	6 37	6 40	6 43	6 47	6 51	6 55	7 00	7 07
14	7 20	7 23	7 25	7 29	7 32	7 36	7 40	7 44	7 49	7 54	8 01	8 08	8 16	8 25
15	8 16	8 20	8 23	8 27	8 32	8 37	8 42	8 48	8 54	9 02	9 10	9 19	9 31	9 44
16	9 12	9 16	9 21	9 26	9 31	9 37	9 43	9 50	9 58	10 07	10 17	10 29	10 43	11 00
17	10 07	10 12	10 17	10 22	10 28	10 35	10 42	10 50	10 59	11 09	11 21	11 35	11 51	12 11
18	11 01	11 06	11 11	11 17	11 23	11 30	11 37	11 46	11 55	12 06	12 18	12 33	12 50	13 12
19	11 51	11 56	12 02	12 07	12 14	12 20	12 28	12 36	12 45	12 56	13 08	13 22	13 39	14 00
20	12 39	12 44	12 49	12 54	13 00	13 06	13 13	13 20	13 28	13 38	13 49	14 01	14 16	14 34
21	13 24	13 28	13 32	13 36	13 41	13 46	13 52	13 58	14 05	14 13	14 22	14 32	14 44	14 58
22	14 06	14 09	14 12	14 15	14 19	14 23	14 27	14 32	14 37	14 43	14 50	14 57	15 06	15 16
23	14 46	14 47	14 49	14 52	14 54	14 56	14 59	15 02	15 06	15 09	15 13	15 18	15 23	15 29
24	15 24	15 25	15 26	15 26	15 27	15 28	15 29	15 31	15 32	15 33	15 35	15 37	15 39	15 41
25	16 02	16 02	16 01	16 01	16 00	16 00	15 59	15 58	15 58	15 57	15 56	15 55	15 53	15 52

MOONSET

Oct.	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
1	9 40	9 44	9 49	9 53	9 58	10 03	10 09	10 15	10 23	10 31	10 40	10 51	11 03	11 18	11 38
2	10 46	10 50	10 55	11 01	11 06	11 13	11 19	11 27	11 36	11 45	11 56	12 09	12 25	12 44	12 64
3	11 46	11 51	11 56	12 02	12 08	12 14	12 22	12 30	12 39	12 50	13 02	13 16	13 33	13 54	14 14
4	12 39	12 44	12 49	12 55	13 01	13 08	13 15	13 23	13 33	13 43	13 55	14 09	14 25	14 46	15 06
5	13 27	13 31	13 36	13 41	13 47	13 53	14 00	14 08	14 16	14 26	14 36	14 49	15 04	15 22	15 42
6	14 09	14 13	14 17	14 22	14 26	14 32	14 38	14 44	14 51	15 00	15 09	15 19	15 32	15 46	16 03
7	14 46	14 49	14 53	14 56	15 00	15 05	15 10	15 15	15 21	15 27	15 34	15 43	15 52	16 03	16 16
8	15 20	15 22	15 25	15 28	15 31	15 34	15 37	15 41	15 45	15 50	15 55	16 01	16 08	16 16	16 26
9	15 51	15 53	15 54	15 56	15 58	16 00	16 02	16 04	16 07	16 10	16 13	16 17	16 21	16 26	16 34
10	16 21	16 22	16 22	16 23	16 24	16 24	16 25	16 26	16 26	16 27	16 28	16 29	16 31	16 32	16 34
11	16 50	16 50	16 50	16 49	16 49	16 48	16 48	16 47	16 47	16 46	16 45	16 44	16 43	16 42	16 42
12	17 20	17 19	17 17	17 16	17 14	17 12	17 11	17 09	17 06	17 04	17 01	16 58	16 55	16 51	16 51
13	17 51	17 48	17 46	17 44	17 41	17 38	17 35	17 31	17 27	17 23	17 18	17 13	17 07	17 00	17 00
14	18 23	18 20	18 17	18 14	18 10	18 06	18 01	17 56	17 51	17 45	17 38	17 30	17 22	17 11	17 11
15	18 59	18 55	18 51	18 47	18 42	18 37	18 31	18 25	18 18	18 10	18 02	17 52	17 40	17 26	17 26
16	19 39	19 34	19 30	19 24	19 19	19 13	19 06	18 59	18 51	18 41	18 31	18 19	18 04	17 47	17 47
17	20 23	20 18	20 13	20 07	20 01	19 55	19 47	19 39	19 30	19 20	19 08	18 54	18 37	18 17	18 17
18	21 12	21 07	21 02	20 56	20 50	20 43	20 35	20 27	20 18	20 07	19 54	19 40	19 22	19 00	19 00
19	22 07	22 02	21 57	21 51	21 45	21 39	21 31	21 23	21 14	21 04	20 52	20 38	20 21	20 01	20 01
20	23 06	23 02	22 58	22 52	22 47	22 41	22 35	22 27	22 19	22 10	22 00	21 48	21 33	21 16	21 16
21	.. ..	.. ..	.. ..	23 59	23 54	23 49	23 44	23 38	23 32	23 25	23 16	23 07	22 56	22 42	22 42
22	0 10	0 07	0 03	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
23	1 17	1 15	1 12	1 09	1 06	1 02	0 59	0 54	0 50	0 45	0 39	0 32	0 25	0 16	0 16
24	2 27	2 25	2 24	2 22	2 20	2 19	2 17	2 14	2 12	2 09	2 06	2 02	1 58	1 54	1 54
25	3 38	3 38	3 38	3 38	3 38	3 37	3 37	3 37	3 36	3 36	3 36	3 35	3 35	3 34	3 34

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2015
UNIVERSAL TIME FOR MERIDIAN OF GREENWICH
MOONRISE

Lat.	-55°	-50°	-45°	-40°	-35°	-30°	-20°	-10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 24	14 57	15 00	15 02	15 04	15 06	15 07	15 10	15 12	15 14	15 16	15 18	15 21	15 22	15 24
25	16 22	16 19	16 18	16 16	16 15	16 14	16 12	16 10	16 09	16 08	16 06	16 04	16 03	16 02
26	17 47	17 40	17 34	17 29	17 25	17 22	17 15	17 10	17 05	17 00	16 55	16 49	16 46	16 42
27	19 11	18 59	18 50	18 42	18 35	18 29	18 19	18 10	18 02	17 54	17 45	17 36	17 30	17 24
28	20 32	20 16	20 04	19 53	19 44	19 36	19 23	19 11	19 00	18 49	18 38	18 25	18 17	18 09
29	21 47	21 28	21 13	21 00	20 50	20 41	20 25	20 11	19 58	19 46	19 32	19 17	19 08	18 57
30	22 52	22 32	22 15	22 02	21 51	21 41	21 24	21 09	20 56	20 42	20 27	20 11	20 01	19 50
31	23 47	23 26	23 10	22 57	22 46	22 36	22 20	22 05	21 51	21 37	21 23	21 06	20 56	20 45
Nov. 1	.. ..	.. ..	23 58	23 46	23 35	23 26	23 11	22 57	22 44	22 31	22 18	22 02	21 53	21 42
2	0 31	0 12	.. ..	.. ..	.. ..	.. ..	23 57	23 45	23 34	23 23	23 11	22 57	22 49	22 40
3	1 07	0 51	0 38	0 28	0 19	0 11	.. ..	.. ..	.. ..	.. ..	.. ..	23 52	23 45	23 38
4	1 36	1 24	1 14	1 05	0 58	0 52	0 40	0 31	0 22	0 12	0 03	.. ..	.. ..	.. ..
5	2 01	1 52	1 45	1 39	1 33	1 29	1 21	1 13	1 07	1 00	0 53	0 45	0 40	0 34
6	2 23	2 18	2 14	2 10	2 07	2 04	1 59	1 54	1 50	1 46	1 42	1 37	1 34	1 30
7	2 44	2 42	2 41	2 39	2 38	2 37	2 36	2 34	2 33	2 31	2 30	2 28	2 27	2 26
8	3 04	3 06	3 07	3 08	3 09	3 10	3 12	3 13	3 15	3 16	3 18	3 19	3 20	3 21
9	3 25	3 30	3 34	3 38	3 41	3 44	3 49	3 53	3 57	4 01	4 06	4 11	4 14	4 17
10	3 47	3 56	4 03	4 09	4 14	4 19	4 27	4 34	4 41	4 48	4 55	5 03	5 08	5 13
11	4 12	4 24	4 34	4 42	4 50	4 56	5 07	5 17	5 26	5 35	5 45	5 56	6 02	6 10
12	4 41	4 56	5 09	5 19	5 28	5 36	5 49	6 01	6 12	6 24	6 36	6 49	6 57	7 07
13	5 15	5 34	5 48	6 00	6 10	6 19	6 35	6 48	7 01	7 14	7 27	7 43	7 52	8 03
14	5 57	6 17	6 33	6 46	6 57	7 06	7 23	7 38	7 51	8 05	8 20	8 36	8 46	8 57
15	6 47	7 07	7 23	7 36	7 48	7 57	8 14	8 29	8 43	8 57	9 11	9 28	9 38	9 50
16	7 45	8 04	8 19	8 32	8 42	8 52	9 08	9 22	9 35	9 48	10 02	10 18	10 28	10 38
17	8 50	9 07	9 20	9 31	9 41	9 49	10 04	10 16	10 28	10 39	10 52	11 06	11 14	11 24

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 24	3 15	3 10	3 06	3 03	3 00	2 58	2 53	2 49	2 45	2 41	2 37	2 33	2 30	2 27
25	3 42	3 42	3 42	3 41	3 41	3 41	3 41	3 40	3 40	3 40	3 39	3 39	3 38	3 38
26	4 09	4 14	4 17	4 20	4 23	4 25	4 29	4 32	4 35	4 39	4 42	4 46	4 48	4 51
27	4 38	4 47	4 54	5 00	5 06	5 10	5 18	5 25	5 32	5 39	5 46	5 54	5 59	6 04
28	5 11	5 24	5 35	5 44	5 51	5 58	6 10	6 20	6 30	6 39	6 50	7 01	7 08	7 16
29	5 49	6 06	6 19	6 31	6 40	6 49	7 03	7 16	7 28	7 40	7 53	8 07	8 16	8 25
30	6 33	6 53	7 09	7 21	7 32	7 42	7 58	8 12	8 26	8 39	8 54	9 10	9 19	9 30
31	7 25	7 46	8 02	8 16	8 27	8 37	8 54	9 09	9 22	9 36	9 51	10 08	10 18	10 29
Nov. 1	8 24	8 44	8 59	9 12	9 23	9 33	9 49	10 04	10 17	10 30	10 44	11 01	11 10	11 21
2	9 26	9 44	9 58	10 10	10 20	10 29	10 43	10 56	11 09	11 21	11 33	11 48	11 57	12 06
3	10 31	10 46	10 58	11 08	11 16	11 23	11 36	11 47	11 57	12 08	12 18	12 31	12 38	12 46
4	11 37	11 48	11 57	12 05	12 12	12 17	12 27	12 36	12 44	12 52	13 00	13 10	13 15	13 21
5	12 42	12 50	12 56	13 02	13 06	13 10	13 17	13 22	13 28	13 33	13 39	13 46	13 49	13 53
6	13 48	13 52	13 55	13 57	14 00	14 02	14 05	14 08	14 11	14 14	14 16	14 20	14 22	14 24
7	14 53	14 53	14 53	14 53	14 53	14 53	14 53	14 53	14 53	14 53	14 53	14 53	14 53	14 53
8	15 57	15 54	15 51	15 48	15 46	15 44	15 41	15 38	15 35	15 32	15 30	15 26	15 24	15 22
9	17 03	16 55	16 49	16 44	16 40	16 36	16 29	16 24	16 18	16 13	16 07	16 00	15 57	15 52
10	18 08	17 57	17 48	17 40	17 34	17 28	17 19	17 10	17 02	16 54	16 46	16 36	16 31	16 24
11	19 13	18 58	18 47	18 37	18 29	18 22	18 09	17 58	17 48	17 38	17 27	17 15	17 07	16 59
12	20 17	19 59	19 45	19 34	19 24	19 15	19 01	18 48	18 36	18 24	18 11	17 56	17 48	17 38
13	21 17	20 57	20 42	20 29	20 18	20 09	19 53	19 38	19 25	19 12	18 57	18 41	18 32	18 21
14	22 12	21 52	21 36	21 23	21 11	21 01	20 45	20 30	20 16	20 02	19 47	19 30	19 20	19 09
15	23 01	22 42	22 26	22 13	22 02	21 52	21 36	21 21	21 08	20 54	20 40	20 23	20 13	20 02
16	23 44	23 26	23 12	23 00	22 50	22 41	22 26	22 13	22 00	21 48	21 34	21 19	21 10	21 00
17	.. ..	.. ..	23 53	23 43	23 35	23 28	23 15	23 03	22 53	22 42	22 31	22 17	22 10	22 01

.. .. indicates phenomenon will occur the next day.

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 24	15 24	15 25	15 26	15 26	15 27	15 28	15 29	15 31	15 32	15 33	15 35	15 37	15 39	15 41
25	16 02	16 02	16 01	16 01	16 00	16 00	15 59	15 58	15 58	15 57	15 56	15 55	15 53	15 52
26	16 42	16 40	16 38	16 37	16 35	16 32	16 30	16 27	16 24	16 21	16 18	16 14	16 09	16 04
27	17 24	17 21	17 18	17 15	17 11	17 07	17 03	16 59	16 54	16 49	16 43	16 36	16 28	16 18
28	18 09	18 05	18 01	17 56	17 52	17 47	17 41	17 35	17 28	17 21	17 12	17 02	16 51	16 37
29	18 57	18 53	18 48	18 43	18 37	18 31	18 24	18 17	18 08	17 59	17 48	17 36	17 21	17 04
30	19 50	19 45	19 40	19 34	19 28	19 21	19 14	19 05	18 56	18 46	18 34	18 20	18 03	17 42
31	20 45	20 40	20 35	20 29	20 23	20 16	20 09	20 00	19 51	19 41	19 28	19 14	18 57	18 36
Nov. 1	21 42	21 38	21 33	21 27	21 22	21 15	21 08	21 01	20 52	20 42	20 31	20 18	20 02	19 43
2	22 40	22 36	22 32	22 27	22 22	22 17	22 11	22 04	21 57	21 48	21 39	21 28	21 15	20 59
3	23 38	23 34	23 31	23 27	23 23	23 19	23 14	23 09	23 03	22 56	22 49	22 40	22 30	22 18
4	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 59	23 53	23 46	23 38
5	0 34	0 32	0 30	0 27	0 24	0 21	0 17	0 13	0 09	0 04	.. ..	.. ..	.. ..	.. ..
6	1 30	1 29	1 27	1 26	1 24	1 22	1 20	1 18	1 15	1 12	1 09	1 06	1 01	0 57
7	2 26	2 26	2 25	2 24	2 24	2 23	2 23	2 22	2 21	2 20	2 19	2 18	2 16	2 15
8	3 21	3 22	3 22	3 23	3 24	3 24	3 25	3 26	3 27	3 28	3 29	3 30	3 31	3 33
9	4 17	4 19	4 20	4 22	4 24	4 26	4 28	4 30	4 33	4 36	4 39	4 43	4 47	4 52
10	5 13	5 16	5 18	5 21	5 24	5 27	5 31	5 35	5 39	5 44	5 49	5 55	6 03	6 11
11	6 10	6 13	6 17	6 20	6 25	6 29	6 34	6 39	6 45	6 52	7 00	7 08	7 19	7 31
12	7 07	7 11	7 15	7 20	7 25	7 30	7 36	7 43	7 51	7 59	8 09	8 20	8 33	8 49
13	8 03	8 07	8 12	8 18	8 24	8 30	8 37	8 45	8 54	9 04	9 15	9 28	9 44	10 04
14	8 57	9 02	9 08	9 14	9 20	9 27	9 34	9 43	9 52	10 03	10 15	10 30	10 48	11 09
15	9 50	9 55	10 00	10 06	10 12	10 19	10 27	10 35	10 45	10 55	11 08	11 22	11 40	12 02
16	10 38	10 43	10 48	10 54	11 00	11 06	11 13	11 21	11 30	11 40	11 51	12 05	12 20	12 40
17	11 24	11 28	11 32	11 37	11 42	11 48	11 54	12 01	12 08	12 17	12 26	12 37	12 51	13 06

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 24	2 27	2 25	2 24	2 22	2 20	2 19	2 17	2 14	2 12	2 09	2 06	2 02	1 58	1 54
25	3 38	3 38	3 38	3 38	3 37	3 37	3 37	3 37	3 36	3 36	3 36	3 35	3 35	3 34
26	4 51	4 52	4 53	4 54	4 56	4 57	4 59	5 01	5 03	5 05	5 07	5 10	5 13	5 17
27	6 04	6 06	6 09	6 11	6 14	6 17	6 21	6 25	6 29	6 34	6 39	6 45	6 52	7 00
28	7 16	7 19	7 23	7 27	7 31	7 36	7 41	7 47	7 53	8 00	8 08	8 17	8 28	8 41
29	8 25	8 30	8 34	8 39	8 45	8 51	8 57	9 04	9 12	9 21	9 32	9 44	9 58	10 15
30	9 30	9 35	9 40	9 46	9 52	9 59	10 06	10 14	10 23	10 33	10 45	10 59	11 16	11 36
31	10 29	10 34	10 39	10 45	10 51	10 58	11 06	11 14	11 23	11 34	11 46	12 00	12 18	12 39
Nov. 1	11 21	11 26	11 31	11 36	11 42	11 49	11 56	12 04	12 13	12 23	12 34	12 47	13 03	13 23
2	12 06	12 10	12 15	12 20	12 25	12 31	12 37	12 44	12 52	13 01	13 11	13 22	13 36	13 52
3	12 46	12 49	12 53	12 57	13 02	13 07	13 12	13 18	13 24	13 31	13 39	13 48	13 59	14 12
4	13 21	13 24	13 27	13 30	13 33	13 37	13 41	13 45	13 50	13 56	14 02	14 08	14 16	14 26
5	13 53	13 55	13 57	13 59	14 02	14 04	14 07	14 10	14 13	14 17	14 21	14 25	14 30	14 36
6	14 24	14 25	14 26	14 27	14 28	14 29	14 30	14 32	14 33	14 35	14 37	14 39	14 42	14 45
7	14 53	14 53	14 53	14 53	14 53	14 53	14 53	14 53	14 53	14 53	14 53	14 53	14 53	14 53
8	15 22	15 21	15 20	15 19	15 18	15 17	15 15	15 14	15 12	15 10	15 08	15 06	15 04	15 01
9	15 52	15 50	15 48	15 46	15 44	15 42	15 39	15 36	15 33	15 29	15 25	15 20	15 15	15 09
10	16 24	16 22	16 19	16 16	16 12	16 08	16 04	16 00	15 55	15 50	15 44	15 37	15 29	15 19
11	16 59	16 56	16 52	16 48	16 43	16 38	16 33	16 27	16 21	16 14	16 06	15 56	15 45	15 32
12	17 38	17 34	17 29	17 24	17 19	17 13	17 06	16 59	16 52	16 43	16 33	16 21	16 07	15 51
13	18 21	18 16	18 11	18 05	17 59	17 53	17 46	17 38	17 29	17 19	17 07	16 53	16 37	16 17
14	19 09	19 04	18 58	18 53	18 46	18 39	18 32	18 23	18 14	18 03	17 50	17 36	17 18	16 56
15	20 02	19 57	19 52	19 46	19 40	19 33	19 25	19 17	19 08	18 57	18 45	18 30	18 13	17 51
16	21 00	20 55	20 50	20 45	20 39	20 33	20 26	20 18	20 10	20 00	19 49	19 36	19 20	19 01
17	22 01	21 57	21 53	21 49	21 44	21 38	21 33	21 26	21 19	21 11	21 02	20 51	20 39	20 24

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2015
UNIVERSAL TIME FOR MERIDIAN OF GREENWICH
MOONRISE

Lat.	-55°	-50°	-45°	-40°	-35°	-30°	-20°	-10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Nov. 16	7 45	8 04	8 19	8 32	8 42	8 52	9 08	9 22	9 35	9 48	10 02	10 18	10 28	10 38
17	8 50	9 07	9 20	9 31	9 41	9 49	10 04	10 16	10 28	10 39	10 52	11 06	11 14	11 24
18	10 01	10 15	10 26	10 34	10 42	10 49	11 00	11 11	11 20	11 30	11 40	11 51	11 58	12 05
19	11 17	11 26	11 34	11 40	11 45	11 50	11 58	12 05	12 12	12 19	12 26	12 34	12 39	12 44
20	12 35	12 40	12 44	12 47	12 50	12 53	12 57	13 01	13 04	13 08	13 12	13 16	13 19	13 22
21	13 56	13 56	13 56	13 56	13 56	13 56	13 56	13 57	13 57	13 57	13 57	13 58	13 58	13 58
22	15 18	15 13	15 09	15 06	15 03	15 01	14 57	14 54	14 50	14 47	14 44	14 40	14 38	14 35
23	16 40	16 31	16 23	16 17	16 12	16 07	15 59	15 52	15 45	15 39	15 32	15 24	15 19	15 14
24	18 02	17 48	17 37	17 28	17 20	17 13	17 02	16 51	16 42	16 32	16 22	16 11	16 04	15 57
25	19 21	19 03	18 49	18 37	18 28	18 19	18 04	17 51	17 39	17 28	17 15	17 00	16 52	16 43
26	20 32	20 12	19 56	19 43	19 32	19 22	19 06	18 51	18 38	18 24	18 10	17 54	17 44	17 33
27	21 34	21 13	20 56	20 43	20 31	20 21	20 04	19 49	19 35	19 21	19 07	18 49	18 40	18 28
28	22 25	22 05	21 49	21 36	21 25	21 16	20 59	20 45	20 31	20 18	20 03	19 47	19 37	19 26
29	23 05	22 48	22 34	22 23	22 13	22 04	21 49	21 36	21 24	21 12	20 59	20 44	20 35	20 25
30	23 38	23 24	23 13	23 03	22 55	22 48	22 35	22 24	22 14	22 04	21 53	21 40	21 33	21 25
Dec. 1	.. ..	23 55	23 46	23 39	23 33	23 27	23 18	23 09	23 01	22 53	22 45	22 35	22 30	22 23
2	0 06	.. ..	.. ..	.. ..	.. ..	.. ..	23 57	23 51	23 46	23 41	23 35	23 29	23 25	23 21
3	0 29	0 22	0 16	0 11	0 07	0 03	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
4	0 50	0 47	0 44	0 42	0 39	0 38	0 35	0 32	0 29	0 27	0 24	0 21	0 19	0 17
5	1 10	1 10	1 11	1 11	1 11	1 11	1 11	1 11	1 11	1 12	1 12	1 12	1 12	1 12
6	1 30	1 34	1 37	1 40	1 42	1 44	1 48	1 51	1 54	1 57	2 00	2 03	2 06	2 08
7	1 52	1 59	2 05	2 10	2 14	2 18	2 25	2 31	2 37	2 42	2 48	2 55	2 59	3 04
8	2 15	2 26	2 35	2 42	2 49	2 54	3 04	3 13	3 21	3 29	3 38	3 48	3 54	4 00
9	2 42	2 56	3 08	3 17	3 26	3 33	3 45	3 56	4 07	4 17	4 29	4 41	4 49	4 57
10	3 14	3 31	3 45	3 57	4 06	4 15	4 30	4 43	4 55	5 07	5 21	5 36	5 44	5 54

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Nov. 16	23 44	23 26	23 12	23 00	22 50	22 41	22 26	22 13	22 00	21 48	21 34	21 19	21 10	21 00
17	.. ..	.. ..	23 53	23 43	23 35	23 28	23 15	23 03	22 53	22 42	22 31	22 17	22 10	22 01
18	0 19	0 05	.. ..	.. ..	.. ..	.. ..	.. ..	23 53	23 45	23 37	23 28	23 18	23 12	23 05
19	0 51	0 40	0 31	0 24	0 17	0 12	0 02	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
20	1 18	1 12	1 06	1 01	0 57	0 54	0 48	0 42	0 37	0 32	0 26	0 20	0 16	0 12
21	1 44	1 42	1 40	1 38	1 37	1 35	1 33	1 31	1 29	1 27	1 25	1 23	1 21	1 20
22	2 10	2 12	2 13	2 15	2 16	2 17	2 19	2 21	2 22	2 24	2 25	2 27	2 28	2 29
23	2 36	2 43	2 48	2 53	2 57	3 00	3 06	3 11	3 16	3 21	3 26	3 32	3 36	3 40
24	3 06	3 17	3 26	3 33	3 40	3 45	3 55	4 04	4 12	4 20	4 29	4 39	4 44	4 51
25	3 40	3 55	4 07	4 17	4 26	4 33	4 47	4 58	5 09	5 20	5 32	5 45	5 52	6 01
26	4 20	4 39	4 54	5 06	5 16	5 25	5 41	5 54	6 07	6 20	6 34	6 49	6 59	7 09
27	5 09	5 29	5 45	5 59	6 10	6 20	6 37	6 52	7 05	7 19	7 34	7 51	8 01	8 12
28	6 05	6 26	6 42	6 55	7 07	7 17	7 34	7 48	8 02	8 16	8 31	8 48	8 58	9 09
29	7 07	7 26	7 42	7 54	8 05	8 14	8 30	8 44	8 57	9 10	9 24	9 39	9 48	9 59
30	8 13	8 30	8 43	8 54	9 03	9 11	9 25	9 37	9 48	10 00	10 12	10 25	10 33	10 42
Dec. 1	9 21	9 34	9 44	9 53	10 00	10 07	10 18	10 28	10 37	10 46	10 56	11 07	11 13	11 20
2	10 28	10 37	10 45	10 51	10 56	11 01	11 09	11 16	11 23	11 30	11 37	11 45	11 49	11 54
3	11 34	11 39	11 44	11 48	11 51	11 54	11 59	12 03	12 07	12 11	12 15	12 20	12 23	12 26
4	12 39	12 41	12 42	12 44	12 45	12 46	12 47	12 48	12 50	12 51	12 52	12 53	12 54	12 55
5	13 44	13 42	13 41	13 39	13 38	13 37	13 35	13 33	13 32	13 30	13 29	13 27	13 26	13 24
6	14 49	14 44	14 39	14 35	14 31	14 28	14 23	14 19	14 14	14 10	14 05	14 00	13 57	13 54
7	15 55	15 45	15 37	15 31	15 25	15 20	15 12	15 05	14 58	14 51	14 43	14 35	14 30	14 25
8	17 00	16 47	16 36	16 28	16 20	16 13	16 02	15 52	15 43	15 33	15 24	15 12	15 06	14 58
9	18 05	17 49	17 36	17 25	17 15	17 07	16 53	16 41	16 30	16 18	16 06	15 52	15 44	15 35
10	19 08	18 49	18 34	18 21	18 11	18 02	17 46	17 32	17 19	17 06	16 52	16 36	16 27	16 17

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2015
UNIVERSAL TIME FOR MERIDIAN OF GREENWICH
MOONRISE

61

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Nov. 16	10 38	10 43	10 48	10 54	11 00	11 06	11 13	11 21	11 30	11 40	11 51	12 05	12 20	12 40
17	11 24	11 28	11 32	11 37	11 42	11 48	11 54	12 01	12 08	12 17	12 26	12 37	12 51	13 06
18	12 05	12 09	12 12	12 16	12 20	12 25	12 29	12 35	12 41	12 47	12 55	13 03	13 13	13 25
19	12 44	12 47	12 49	12 52	12 55	12 58	13 01	13 05	13 09	13 14	13 19	13 24	13 31	13 39
20	13 22	13 23	13 24	13 26	13 27	13 29	13 31	13 32	13 35	13 37	13 40	13 43	13 46	13 50
21	13 58	13 58	13 58	13 58	13 59	13 59	13 59	13 59	13 59	13 59	14 00	14 00	14 00	14 01
22	14 35	14 34	14 33	14 32	14 31	14 29	14 28	14 26	14 24	14 22	14 20	14 17	14 14	14 11
23	15 14	15 12	15 10	15 07	15 04	15 02	14 58	14 55	14 51	14 47	14 42	14 36	14 30	14 23
24	15 57	15 53	15 50	15 46	15 42	15 37	15 33	15 27	15 21	15 15	15 08	14 59	14 50	14 38
25	16 43	16 39	16 34	16 29	16 24	16 18	16 12	16 05	15 58	15 49	15 40	15 28	15 15	15 00
26	17 33	17 29	17 23	17 18	17 12	17 05	16 58	16 50	16 41	16 31	16 20	16 06	15 50	15 31
27	18 28	18 23	18 18	18 12	18 06	17 59	17 51	17 43	17 33	17 23	17 10	16 56	16 38	16 17
28	19 26	19 21	19 16	19 10	19 04	18 58	18 50	18 42	18 33	18 22	18 10	17 56	17 40	17 19
29	20 25	20 21	20 16	20 11	20 06	20 00	19 53	19 46	19 38	19 28	19 18	19 06	18 51	18 33
30	21 25	21 21	21 17	21 13	21 08	21 03	20 58	20 52	20 45	20 38	20 29	20 19	20 08	19 54
Dec. 1	22 23	22 20	22 17	22 14	22 11	22 07	22 03	21 58	21 53	21 48	21 41	21 34	21 25	21 15
2	23 21	23 19	23 17	23 14	23 12	23 10	23 07	23 04	23 01	22 57	22 53	22 48	22 43	22 36
3	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 59	23 56
4	0 17	0 16	0 15	0 14	0 13	0 12	0 10	0 09	0 07	0 05	0 04	0 01	.. ..	.. ..
5	1 12	1 13	1 13	1 13	1 13	1 13	1 13	1 13	1 13	1 13	1 14	1 14	1 14	1 14
6	2 08	2 09	2 10	2 11	2 13	2 14	2 16	2 17	2 19	2 21	2 24	2 26	2 29	2 33
7	3 04	3 06	3 08	3 10	3 13	3 16	3 19	3 22	3 25	3 29	3 34	3 39	3 45	3 52
8	4 00	4 03	4 06	4 10	4 13	4 17	4 22	4 27	4 32	4 38	4 45	4 52	5 01	5 12
9	4 57	5 01	5 05	5 10	5 14	5 19	5 25	5 31	5 38	5 46	5 55	6 05	6 17	6 32
10	5 54	5 59	6 04	6 09	6 15	6 21	6 27	6 35	6 43	6 53	7 03	7 16	7 31	7 50

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Nov. 16	21 00	20 55	20 50	20 45	20 39	20 33	20 26	20 18	20 10	20 00	19 49	19 36	19 20	19 01
17	22 01	21 57	21 53	21 49	21 44	21 38	21 33	21 26	21 19	21 11	21 02	20 51	20 39	20 24
18	23 05	23 02	22 59	22 56	22 52	22 48	22 44	22 39	22 34	22 28	22 21	22 13	22 04	21 53
19	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 58	23 55	23 52	23 48	23 44	23 39	23 33	23 27
20	0 12	0 10	0 08	0 06	0 03	0 01	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
21	1 20	1 19	1 18	1 17	1 17	1 16	1 15	1 13	1 12	1 11	1 09	1 07	1 05	1 03
22	2 29	2 30	2 30	2 31	2 31	2 32	2 33	2 34	2 35	2 35	2 37	2 38	2 39	2 41
23	3 40	3 41	3 43	3 45	3 47	3 50	3 52	3 55	3 58	4 02	4 05	4 10	4 15	4 21
24	4 51	4 54	4 57	5 00	5 04	5 08	5 12	5 17	5 22	5 28	5 34	5 42	5 51	6 01
25	6 01	6 05	6 09	6 14	6 19	6 24	6 30	6 36	6 43	6 51	7 01	7 11	7 24	7 39
26	7 09	7 14	7 19	7 24	7 30	7 36	7 43	7 51	7 59	8 09	8 20	8 34	8 49	9 08
27	8 12	8 17	8 22	8 28	8 34	8 41	8 49	8 57	9 07	9 17	9 30	9 44	10 01	10 23
28	9 09	9 14	9 19	9 25	9 31	9 38	9 45	9 54	10 03	10 13	10 26	10 40	10 57	11 18
29	9 59	10 03	10 08	10 13	10 19	10 25	10 32	10 40	10 48	10 58	11 09	11 21	11 36	11 55
30	10 42	10 46	10 50	10 55	11 00	11 05	11 11	11 17	11 24	11 32	11 42	11 52	12 04	12 19
Dec. 1	11 20	11 23	11 27	11 30	11 34	11 39	11 43	11 48	11 54	12 00	12 07	12 15	12 24	12 35
2	11 54	11 57	11 59	12 02	12 04	12 07	12 11	12 14	12 18	12 23	12 28	12 33	12 39	12 47
3	12 26	12 27	12 28	12 30	12 32	12 33	12 35	12 37	12 40	12 42	12 45	12 48	12 52	12 56
4	12 55	12 56	12 56	12 56	12 57	12 57	12 58	12 59	12 59	13 00	13 01	13 02	13 03	13 04
5	13 24	13 24	13 23	13 23	13 22	13 21	13 20	13 19	13 19	13 17	13 16	13 15	13 13	13 12
6	13 54	13 52	13 51	13 49	13 47	13 45	13 43	13 41	13 38	13 35	13 32	13 28	13 24	13 20
7	14 25	14 22	14 20	14 17	14 14	14 11	14 07	14 04	13 59	13 55	13 49	13 43	13 37	13 29
8	14 58	14 55	14 51	14 48	14 44	14 39	14 35	14 29	14 23	14 17	14 10	14 01	13 52	13 40
9	15 35	15 31	15 27	15 22	15 17	15 12	15 06	14 59	14 52	14 44	14 34	14 23	14 11	13 56
10	16 17	16 12	16 07	16 02	15 56	15 50	15 43	15 35	15 26	15 17	15 05	14 53	14 37	14 18

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2015
UNIVERSAL TIME FOR MERIDIAN OF GREENWICH
MOONRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Dec. 9	2 42	2 56	3 08	3 17	3 26	3 33	3 45	3 56	4 07	4 17	4 29	4 41	4 49	4 57
10	3 14	3 31	3 45	3 57	4 06	4 15	4 30	4 43	4 55	5 07	5 21	5 36	5 44	5 54
11	3 53	4 13	4 28	4 41	4 52	5 01	5 18	5 32	5 45	5 59	6 13	6 30	6 40	6 51
12	4 40	5 01	5 17	5 30	5 42	5 52	6 09	6 24	6 38	6 52	7 07	7 24	7 34	7 45
13	5 36	5 56	6 12	6 25	6 36	6 46	7 03	7 17	7 31	7 44	7 59	8 16	8 25	8 36
14	6 40	6 59	7 13	7 25	7 35	7 44	7 59	8 12	8 24	8 37	8 50	9 05	9 14	9 24
15	7 51	8 06	8 18	8 27	8 36	8 43	8 56	9 07	9 17	9 28	9 39	9 51	9 59	10 07
16	9 05	9 16	9 25	9 32	9 39	9 44	9 54	10 02	10 10	10 18	10 26	10 35	10 41	10 47
17	10 22	10 29	10 34	10 39	10 42	10 46	10 52	10 57	11 01	11 06	11 11	11 17	11 20	11 24
18	11 41	11 43	11 44	11 46	11 47	11 48	11 50	11 51	11 53	11 54	11 56	11 58	11 59	12 00
19	13 00	12 57	12 55	12 53	12 52	12 50	12 48	12 46	12 44	12 42	12 40	12 38	12 37	12 36
20	14 20	14 13	14 07	14 02	13 57	13 54	13 47	13 42	13 37	13 31	13 26	13 20	13 16	13 12
21	15 40	15 28	15 18	15 10	15 04	14 58	14 47	14 39	14 30	14 22	14 13	14 03	13 58	13 51
22	16 58	16 42	16 29	16 18	16 09	16 02	15 48	15 36	15 26	15 15	15 03	14 50	14 43	14 34
23	18 11	17 52	17 37	17 24	17 14	17 05	16 49	16 35	16 22	16 09	15 56	15 40	15 31	15 21
24	19 17	18 56	18 40	18 26	18 15	18 05	17 48	17 33	17 19	17 05	16 51	16 34	16 24	16 13
25	20 13	19 53	19 36	19 23	19 12	19 02	18 45	18 30	18 16	18 02	17 47	17 30	17 20	17 09
26	21 00	20 41	20 26	20 13	20 03	19 54	19 38	19 24	19 11	18 58	18 44	18 28	18 18	18 08
27	21 37	21 21	21 08	20 57	20 48	20 40	20 26	20 14	20 03	19 52	19 39	19 25	19 17	19 08
28	22 07	21 55	21 45	21 36	21 29	21 22	21 11	21 02	20 52	20 43	20 33	20 22	20 16	20 08
29	22 33	22 24	22 17	22 11	22 05	22 01	21 53	21 46	21 39	21 32	21 25	21 17	21 12	21 07
30	22 56	22 50	22 46	22 42	22 39	22 37	22 32	22 28	22 24	22 20	22 15	22 11	22 08	22 05
31	23 16	23 15	23 13	23 12	23 11	23 10	23 09	23 08	23 07	23 05	23 04	23 03	23 02	23 01
32	23 36	23 38	23 40	23 41	23 43	23 44	23 46	23 47	23 49	23 51	23 52	23 54	23 56	23 57
33	23 57	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Dec. 9	18 05	17 49	17 36	17 25	17 15	17 07	16 53	16 41	16 30	16 18	16 06	15 52	15 44	15 35
10	19 08	18 49	18 34	18 21	18 11	18 02	17 46	17 32	17 19	17 06	16 52	16 36	16 27	16 17
11	20 07	19 46	19 30	19 17	19 06	18 56	18 39	18 24	18 10	17 56	17 42	17 25	17 15	17 04
12	20 59	20 39	20 23	20 10	19 58	19 49	19 32	19 17	19 03	18 49	18 34	18 17	18 07	17 56
13	21 45	21 26	21 11	20 59	20 48	20 39	20 23	20 09	19 56	19 43	19 29	19 13	19 04	18 53
14	22 23	22 08	21 55	21 44	21 35	21 27	21 13	21 01	20 50	20 38	20 26	20 12	20 04	19 54
15	22 56	22 44	22 34	22 26	22 19	22 12	22 01	21 52	21 42	21 33	21 23	21 12	21 06	20 58
16	23 25	23 16	23 10	23 04	22 59	22 55	22 47	22 41	22 34	22 28	22 21	22 13	22 09	22 04
17	23 51	23 47	23 43	23 41	23 38	23 36	23 32	23 29	23 26	23 23	23 19	23 15	23 13	23 10
18	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
19	0 15	0 16	0 16	0 16	0 16	0 16	0 17	0 17	0 17	0 17	0 17	0 18	0 18	0 18
20	0 40	0 45	0 49	0 52	0 55	0 57	1 02	1 05	1 09	1 12	1 16	1 20	1 23	1 26
21	1 07	1 16	1 24	1 30	1 35	1 40	1 48	1 55	2 02	2 09	2 16	2 24	2 29	2 34
22	1 38	1 51	2 02	2 10	2 18	2 25	2 36	2 47	2 56	3 06	3 16	3 28	3 35	3 43
23	2 13	2 30	2 44	2 55	3 05	3 13	3 28	3 40	3 52	4 04	4 17	4 32	4 40	4 50
24	2 56	3 16	3 32	3 45	3 56	4 05	4 22	4 36	4 49	5 03	5 17	5 34	5 43	5 54
25	3 48	4 09	4 25	4 39	4 50	5 00	5 17	5 32	5 47	6 01	6 15	6 33	6 42	6 54
26	4 47	5 07	5 23	5 37	5 48	5 57	6 14	6 29	6 42	6 56	7 10	7 27	7 37	7 47
27	5 52	6 10	6 25	6 36	6 47	6 55	7 11	7 24	7 36	7 48	8 01	8 16	8 25	8 35
28	7 00	7 15	7 27	7 37	7 45	7 53	8 05	8 17	8 27	8 37	8 48	9 01	9 08	9 16
29	8 08	8 20	8 29	8 37	8 43	8 49	8 59	9 07	9 15	9 23	9 31	9 41	9 46	9 53
30	9 16	9 24	9 30	9 35	9 39	9 43	9 50	9 55	10 01	10 06	10 12	10 18	10 22	10 26
31	10 23	10 27	10 30	10 32	10 34	10 36	10 39	10 42	10 44	10 47	10 50	10 53	10 54	10 56
32	11 29	11 29	11 28	11 28	11 28	11 28	11 28	11 27	11 27	11 27	11 27	11 26	11 26	11 26
33	12 34	12 30	12 27	12 24	12 21	12 19	12 16	12 12	12 09	12 06	12 03	12 00	11 57	11 55

.. .. indicates phenomenon will occur the next day.

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Dec. 9	4 57	5 01	5 05	5 10	5 14	5 19	5 25	5 31	5 38	5 46	5 55	6 05	6 17	6 32
10	5 54	5 59	6 04	6 09	6 15	6 21	6 27	6 35	6 43	6 53	7 03	7 16	7 31	7 50
11	6 51	6 56	7 01	7 07	7 13	7 20	7 27	7 36	7 45	7 55	8 08	8 22	8 39	9 01
12	7 45	7 50	7 56	8 02	8 08	8 15	8 23	8 31	8 41	8 52	9 05	9 20	9 37	10 00
13	8 36	8 41	8 47	8 52	8 58	9 05	9 12	9 21	9 30	9 40	9 52	10 06	10 23	10 44
14	9 24	9 28	9 33	9 38	9 43	9 49	9 56	10 03	10 11	10 20	10 31	10 43	10 57	11 15
15	10 07	10 11	10 15	10 19	10 23	10 28	10 34	10 39	10 46	10 53	11 02	11 11	11 22	11 35
16	10 47	10 50	10 52	10 56	10 59	11 02	11 06	11 11	11 16	11 21	11 27	11 34	11 41	11 50
17	11 24	11 26	11 28	11 29	11 31	11 34	11 36	11 39	11 42	11 45	11 48	11 52	11 57	12 02
18	12 00	12 00	12 01	12 02	12 02	12 03	12 04	12 05	12 06	12 07	12 08	12 09	12 11	12 12
19	12 36	12 35	12 34	12 34	12 33	12 32	12 31	12 30	12 29	12 28	12 27	12 25	12 24	12 22
20	13 12	13 11	13 09	13 07	13 05	13 02	13 00	12 57	12 54	12 51	12 47	12 43	12 38	12 33
21	13 51	13 49	13 46	13 42	13 39	13 35	13 31	13 27	13 22	13 16	13 10	13 03	12 55	12 45
22	14 34	14 30	14 26	14 22	14 17	14 12	14 06	14 00	13 54	13 46	13 37	13 28	13 16	13 02
23	15 21	15 16	15 12	15 06	15 01	14 55	14 48	14 40	14 32	14 23	14 12	14 00	13 45	13 27
24	16 13	16 08	16 03	15 57	15 51	15 44	15 36	15 28	15 19	15 08	14 56	14 42	14 25	14 04
25	17 09	17 04	16 58	16 53	16 46	16 39	16 32	16 23	16 14	16 03	15 51	15 36	15 19	14 57
26	18 08	18 03	17 58	17 53	17 47	17 40	17 33	17 25	17 16	17 06	16 55	16 42	16 25	16 06
27	19 08	19 04	19 00	18 55	18 50	18 44	18 38	18 31	18 24	18 15	18 05	17 54	17 41	17 25
28	20 08	20 05	20 01	19 58	19 53	19 49	19 44	19 39	19 33	19 26	19 19	19 10	19 00	18 48
29	21 07	21 05	21 02	20 59	20 57	20 53	20 50	20 46	20 42	20 37	20 32	20 26	20 19	20 11
30	22 05	22 03	22 02	22 00	21 59	21 57	21 55	21 52	21 50	21 47	21 44	21 41	21 37	21 32
31	23 01	23 01	23 00	23 00	22 59	22 59	22 58	22 58	22 57	22 56	22 55	22 54	22 53	22 52
32	23 57	23 58	23 58	23 59	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
33	.. ..	.. ..	.. ..	.. ..	0 00	0 00	0 01	0 02	0 03	0 04	0 06	0 07	0 09	0 11

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Dec. 9	15 35	15 31	15 27	15 22	15 17	15 12	15 06	14 59	14 52	14 44	14 34	14 23	14 11	13 56	13 56
10	16 17	16 12	16 07	16 02	15 56	15 50	15 43	15 35	15 26	15 17	15 05	14 53	14 37	14 18	14 18
11	17 04	16 59	16 53	16 47	16 41	16 34	16 27	16 18	16 09	15 58	15 46	15 31	15 14	14 52	14 52
12	17 56	17 51	17 45	17 39	17 33	17 26	17 18	17 10	17 00	16 49	16 37	16 22	16 04	15 41	15 41
13	18 53	18 48	18 43	18 37	18 31	18 25	18 18	18 10	18 01	17 50	17 39	17 25	17 08	16 48	16 48
14	19 54	19 50	19 45	19 41	19 35	19 30	19 23	19 16	19 09	19 00	18 50	18 38	18 25	18 08	18 08
15	20 58	20 55	20 51	20 47	20 43	20 39	20 34	20 28	20 22	20 16	20 08	19 59	19 49	19 36	19 36
16	22 04	22 01	21 59	21 56	21 54	21 50	21 47	21 43	21 39	21 35	21 30	21 24	21 17	21 09	21 09
17	23 10	23 09	23 08	23 07	23 05	23 04	23 02	23 00	22 58	22 56	22 53	22 50	22 47	22 43	22 43
18	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
19	0 18	0 18	0 18	0 18	0 18	0 18	0 18	0 18	0 18	0 18	0 18	0 18	0 18	0 18	0 18
20	1 26	1 27	1 28	1 30	1 31	1 33	1 35	1 37	1 39	1 41	1 44	1 47	1 50	1 55	1 55
21	2 34	2 37	2 39	2 42	2 45	2 48	2 52	2 55	3 00	3 04	3 10	3 16	3 23	3 31	3 31
22	3 43	3 46	3 50	3 54	3 58	4 03	4 08	4 13	4 20	4 27	4 35	4 44	4 55	5 07	5 07
23	4 50	4 54	4 59	5 04	5 09	5 15	5 22	5 29	5 37	5 46	5 56	6 08	6 22	6 40	6 40
24	5 54	5 59	6 04	6 10	6 16	6 23	6 30	6 38	6 47	6 58	7 10	7 24	7 41	8 01	8 01
25	6 54	6 59	7 04	7 10	7 17	7 23	7 31	7 40	7 49	8 00	8 12	8 27	8 45	9 06	9 06
26	7 47	7 52	7 57	8 03	8 09	8 16	8 23	8 31	8 40	8 50	9 02	9 16	9 32	9 52	9 52
27	8 35	8 39	8 44	8 49	8 54	9 00	9 06	9 13	9 21	9 30	9 40	9 52	10 06	10 23	10 23
28	9 16	9 20	9 24	9 28	9 32	9 37	9 42	9 48	9 54	10 02	10 10	10 19	10 30	10 43	10 43
29	9 53	9 55	9 58	10 01	10 05	10 09	10 13	10 17	10 22	10 27	10 33	10 40	10 48	10 57	10 57
30	10 26	10 28	10 29	10 32	10 34	10 36	10 39	10 42	10 45	10 48	10 52	10 56	11 01	11 07	11 07
31	10 56	10 57	10 58	10 59	11 00	11 01	11 03	11 04	11 05	11 07	11 09	11 11	11 13	11 16	11 16
32	11 26	11 26	11 26	11 26	11 25	11 25	11 25	11 25	11 25	11 25	11 25	11 24	11 24	11 24	11 24
33	11 55	11 54	11 53	11 52	11 50	11 49	11 48	11 46	11 44	11 42	11 40	11 37	11 34	11 31	11 31

.. .. indicates phenomenon will occur the next day.

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SUMMARY OF ECLIPSES AND TRANSITS FOR 2015

There are four eclipses, two of the Sun and two of the Moon. All times are expressed in Universal Time using $\Delta T = +68^s.0$. There are no transits of Mercury or Venus across the Sun.

I. *A total eclipse of the Sun*, March 20. See map on page 71. The eclipse begins at 07^h 41^m and ends at 11^h 50^m. Maximum duration of totality is 02^m 50^s. It is visible from Europe, northern Africa, the Middle East, western Asia, and the northern Atlantic Ocean.

II. *A total eclipse of the Moon*, April 4. See map on page 73. The eclipse begins at 09^h 00^m and ends at 15^h 01^m; the total phase begins at 11^h 54^m and ends at 12^h 06^m. It is visible from Asia, Australia, Oceania, North America, South America, Antarctica, the Indian Ocean and the Pacific Ocean.

III. *A partial eclipse of the Sun*, September 13. See map on page 75. The eclipse begins at 04^h 42^m and ends at 09^h 06^m. It is visible from southern Africa, Antarctica, and the southwestern Indian Ocean.

IV. *A total eclipse of the Moon*, September 28. See map on page 76. The eclipse begins at 00^h 10^m and ends at 05^h 24^m; the total phase begins at 02^h 11^m and ends at 03^h 24^m. It is visible from North America, South America, Europe, Africa, Antarctica, the eastern Pacific Ocean, the Atlantic Ocean, and the western Indian Ocean.

Local circumstances and animations for upcoming eclipses can be found on *The Astronomical Almanac Online* at <http://asa.hmnao.com> or <http://asa.usno.navy.mil>.

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General Information

The elements and circumstances are computed according to Bessel's method from apparent right ascensions and declinations of the Sun and Moon. Semidiameters of the Sun and Moon used in the calculation of eclipses do not include irradiation. The adopted semidiameter of the Sun at unit distance is $15' 59''.64$ from the IAU (1976) Astronomical Constants. The apparent semidiameter of the Moon is equal to $\arcsin(k \sin \pi)$, where π is the Moon's horizontal parallax and k is an adopted constant. In 1982, the IAU adopted $k = 0.272\,5076$, corresponding to the mean radius of Watts' datum as determined by observations of occultations and to the adopted radius of the Earth.

Standard corrections of $+0''.5$ and $-0''.25$ have been applied to the longitude and latitude of the Moon, respectively, to help correct for the difference between the center of figure and the center of mass.

Refraction is neglected in calculating solar and lunar eclipses. Because the circumstances of eclipses are calculated for the surface of the ellipsoid, refraction is not included in Besselian element polynomials. For local predictions, corrections for refraction are unnecessary; they are required only in precise comparisons of theory with observation in which many other refinements are also necessary.

All time arguments are given provisionally in Universal Time, using $\Delta T(A) = +68^s.0$. Once an updated value of ΔT is known, the data on these pages may be expressed in Universal Time as follows:

Define $\delta T = \Delta T - \Delta T(A)$, in units of seconds of time.

Change the times of circumstances given in preliminary Universal Time by subtracting δT .

Correct the tabulated longitudes, $\lambda(A)$, using $\lambda = \lambda(A) + 0.00417807 \times \delta T$ (longitudes are in degrees).

Leave all other quantities unchanged.

The correction of δT is included in the Besselian elements.

Longitude is positive to the east, and negative to the west.

Explanation of Solar Eclipse Diagram

The solar eclipse diagrams in *The Astronomical Almanac* show the region over which different phases of each eclipse may be seen and the times at which these phases occur. Each diagram has a series of dashed curves that show the outline of the Moon's penumbra on the Earth's surface at one-hour intervals. Short dashes show the leading edge and long dashes show the trailing edge. Except for certain extreme cases, the shadow outline moves generally from west to east. The Moon's shadow cone first contacts the Earth's surface where "First Contact" is indicated on the diagram. "Last Contact" is where the Moon's shadow cone last contacts the Earth's surface. The path of the central eclipse, whether for a total, annular, or annular-total eclipse, is marked by two closely spaced curves that cut across all of the dashed curves. These two curves mark the extent of the Moon's umbral shadow on the Earth's surface. Viewers within these boundaries will observe a total, annular, or annular-total eclipse and viewers outside these boundaries will see a partial eclipse.

Solid curves labeled "Northern" and "Southern Limit of Eclipse" represent the furthest extent north or south of the Moon's penumbra on the Earth's surface. Viewers outside of

these boundaries will not experience any eclipse. When only one of these two curves appears, only part of the Moon's penumbra touches the Earth; the other part is projected into space north or south of the Earth, and the terminator defines the other limit.

Another set of solid curves appears on some diagrams as two teardrop shapes (or lobes) on either end of the eclipse path, and on other diagrams as a distorted figure eight. These lobes represent in time the intersection of the Moon's penumbra with the Earth's terminator as the eclipse progresses. As time elapses, the Earth's terminator moves east-to-west while the Moon's penumbra moves west-to-east. These lobes connect to form an elongated figure eight on a diagram when part of the Moon's penumbra stays in contact with the Earth's terminator throughout the eclipse. The lobes become two separate teardrop shapes when the Moon's penumbra breaks contact with the Earth's terminator during the beginning of the eclipse and reconnects with it near the end. In the east, the outer portion of the lobe is labeled "Eclipse begins at Sunset" and marks the first contact between the Moon's penumbra and Earth's terminator in the east. Observers on this curve just fail to see the eclipse. The inner part of the lobe is labeled "Eclipse ends at Sunset" and marks the last contact between the Moon's penumbra and the Earth's terminator in the east. Observers on this curve just see the whole eclipse. The curve bisecting this lobe is labeled "Maximum Eclipse at Sunset" and is part of the sunset terminator at maximum eclipse. Viewers in the eastern half of the lobe will see the Sun set before maximum eclipse; *i.e.* see less than half of the eclipse. Viewers in the western half of the lobe will see the Sun set after maximum eclipse; *i.e.* see more than half of the eclipse. A similar description holds for the western lobe except everything occurs at sunrise instead of sunset.

Computing Local Circumstances for Solar Eclipses

The solar eclipse maps show the path of the eclipse, beginning and ending times of the eclipse, and the region of visibility, including restrictions due to rising and setting of the Sun. The short-dash and long-dash lines show, respectively, the progress of the leading and trailing edge of the penumbra; thus, at a given location, the times of the first and last contact may be interpolated. If further precision is desired, Besselian elements can be utilized.

Besselian elements characterize the geometric position of the shadow of the Moon relative to the Earth. The exterior tangents to the surfaces of the Sun and Moon form the umbral cone; the interior tangents form the penumbral cone. The common axis of these two cones is the axis of the shadow. To form a system of geocentric rectangular coordinates, the geocentric plane perpendicular to the axis of the shadow is taken as the xy -plane. This is called the fundamental plane. The x -axis is the intersection of the fundamental plane with the plane of the equator; it is positive toward the east. The y -axis is positive toward the north. The z -axis is parallel to the axis of the shadow and is positive toward the Moon. The tabular values of x and y are the coordinates, in units of the Earth's equatorial radius, of the intersection of the axis of the shadow with the fundamental plane. The direction of the axis of the shadow is specified by the declination d and hour angle μ of the point on the celestial sphere toward which the axis is directed.

The radius of the umbral cone is regarded as positive for an annular eclipse and negative for a total eclipse. The angles f_1 and f_2 are the angles at which the tangents that form the penumbral and umbral cones, respectively, intersect the axis of the shadow.

To predict accurate local circumstances, calculate the geocentric coordinates $\rho \sin \phi'$ and $\rho \cos \phi'$ from the geodetic latitude ϕ and longitude λ , using the relationships given on pages K11–K12 of *The Astronomical Almanac*. Inclusion of the height h in this calculation is all that is necessary to obtain the local circumstances at high altitudes.

Obtain approximate times for the beginning, middle and end of the eclipse from the eclipse map. For each of these three times compute from the Besselian element polynomials, the values of x , y , $\sin d$, $\cos d$, μ and l_1 (the radius of the penumbra on the fundamental plane), except that at the approximate time of the middle of the eclipse l_2 (the radius of the umbra on the fundamental plane) is required instead of l_1 if the eclipse is central (i.e., total, annular or annular-total). The hourly variations x' , y' of x and y are needed, and may be obtained by evaluating the derivative of the polynomial expressions for x and y . Values of μ' , d' , $\tan f_1$ and $\tan f_2$ are nearly constant throughout the eclipse and are given immediately following the Besselian polynomials.

For each of the three approximate times, calculate the coordinates ξ , η , ζ for the observer and the hourly variations ξ' and η' from

$$\begin{aligned}\xi &= \rho \cos \phi' \sin \theta, \\ \eta &= \rho \sin \phi' \cos d - \rho \cos \phi' \sin d \cos \theta, \\ \zeta &= \rho \sin \phi' \sin d + \rho \cos \phi' \cos d \cos \theta, \\ \xi' &= \mu' \rho \cos \phi' \cos \theta, \\ \eta' &= \mu' \xi \sin d - \zeta d',\end{aligned}$$

where

$$\theta = \mu + \lambda$$

for longitudes measured positive towards the east.

Next, calculate

$$\begin{aligned}u &= x - \xi & u' &= x' - \xi' \\ v &= y - \eta & v' &= y' - \eta' \\ m^2 &= u^2 + v^2 & n^2 &= u'^2 + v'^2 \\ L_i &= l_i - \zeta \tan f_i \\ D &= uu' + vv' \\ \Delta &= \frac{1}{n}(uv' - u'v) \\ \sin \psi &= \frac{\Delta}{L_i}\end{aligned} \quad (m, n > 0)$$

where $i = 1, 2$.

At the approximate times of the beginning and end of the eclipse, L_1 is required. At the approximate time of the middle of the eclipse, L_2 is required if the eclipse is central; L_1 is required if the eclipse is partial.

Neglecting the variation of L , the correction τ to be applied to the approximate time of the middle of the eclipse to obtain the *Universal Time of greatest phase* is

$$\tau = -\frac{D}{n^2},$$

which may be expressed in minutes by multiplying by 60. The correction τ to be applied to the approximate times of the beginning and end of the eclipse to obtain the *Universal Times of the penumbral contacts* is

$$\tau = \frac{L_1}{n} \cos \psi - \frac{D}{n^2},$$

which may be expressed in minutes by multiplying by 60.

If the eclipse is central, use the approximate time for the middle of the eclipse as a first approximation to the times of umbral contact. The correction τ to be applied to obtain the *Universal Times of the umbral contacts* is

$$\tau = \frac{L_2}{n} \cos \psi - \frac{D}{n^2},$$

which may be expressed in minutes by multiplying by 60.

In the last two equations, the ambiguity in the quadrant of ψ is removed by noting that $\cos \psi$ must be *negative* for the beginning of the eclipse, for the beginning of the annular phase, or for the end of the total phase; $\cos \psi$ must be *positive* for the end of the eclipse, the end of the annular phase, or the beginning of the total phase.

For greater accuracy, the times resulting from the calculation outlined above should be used in place of the original approximate times, and the entire procedure repeated at least once. The calculations for each of the contact times and the time of greatest phase should be performed separately.

The *magnitude of greatest partial eclipse*, in units of the solar diameter is

$$M_1 = \frac{L_1 - m}{(2L_1 - 0.5459)},$$

where the value of m at the time of greatest phase is used. If the magnitude is negative at the time of greatest phase, no eclipse is visible from the location.

The *magnitude of the central phase*, in the same units is

$$M_2 = \frac{L_1 - L_2}{(L_1 + L_2)}.$$

The *position angle of a point of contact* measured eastward (counterclockwise) from the north point of the solar limb is given by

$$\tan P = \frac{u}{v},$$

where u and v are evaluated at the times of contacts computed in the final approximation. The quadrant of P is determined by noting that $\sin P$ has the algebraic sign of u , except for the contacts of the total phase, for which $\sin P$ has the opposite sign to u .

The position angle of the point of contact measured eastward from the vertex of the solar limb is given by

$$V = P - C,$$

where C , the parallactic angle, is obtained with sufficient accuracy from

$$\tan C = \frac{\xi}{\eta},$$

with $\sin C$ having the same algebraic sign as ξ , and the results of the final approximation again being used. The vertex point of the solar limb lies on a great circle arc drawn from the zenith to the center of the solar disk.

Lunar Eclipses

A calculator to produce local circumstances of recent and upcoming lunar eclipses is provided at <http://aa.usno.navy.mil/data/docs/LunarEclipse.php>

In calculating lunar eclipses the radius of the geocentric shadow of the Earth is increased by one-fiftieth part to allow for the effect of the atmosphere. Refraction is neglected in calculating solar and lunar eclipses. Standard corrections of $+0''.5$ and $-0''.25$ have been applied to the longitude and latitude of the Moon, respectively, to help correct for the difference between the center of figure and the center of mass.

Explanation of Lunar Eclipse Diagram

Information on lunar eclipses is presented in the form of a diagram consisting of two parts. The upper panel shows the path of the Moon relative to the penumbral and umbral shadows of the Earth. The lower panel shows the visibility of the eclipse from the surface of the Earth. The title of the upper panel includes the type of eclipse, its place in the sequence of eclipses for the year and the Greenwich calendar date of the eclipse. The inner darker circle is the umbral shadow of the Earth and the outer lighter circle is that of the penumbra. The axis of the shadow of the Earth is denoted by (+) with the ecliptic shown for reference purposes. A 30-arcminute scale bar is provided on the right hand side of the diagram and the orientation is given by the cardinal points displayed on the small graphic on the left hand side of the diagram. The position angle (PA) is measured from North point of the lunar disk along the limb of the Moon to the point of contact. It is shown on the graphic by the use of an arc extending anti-clockwise (eastwards) from North terminated with an arrow head.

Moon symbols are plotted at the principal phases of the eclipse to show its position relative to the umbral and penumbral shadows. The UT times of the different phases of the eclipse to the nearest tenth of a minute are printed above or below the Moon symbols as appropriate. P1 and P4 are the first and last external contacts of the penumbra respectively and denote the beginning and end of the penumbral eclipse respectively. U1 and U4 are the first and last external contacts of the umbra denoting the beginning and end of the partial phase of the eclipse respectively. U2 and U3 are the first and last internal contacts of the umbra and denote the beginning and end of the total phase respectively. MID is the middle of the eclipse. The position angle is given for P1 and P4 for penumbral eclipses and U1 and U4 for partial and total eclipses. The UT time of the geocentric opposition in right ascension of the Sun and Moon and the magnitude of the eclipse are given above or below the Moon symbols as appropriate.

The lower panel is a cylindrical equidistant map projection showing the Earth centered on the longitude at which the Moon is in the zenith at the middle of the eclipse. The visibility of the eclipse is displayed by plotting the Moon rise/set terminator for the principal phases of the eclipse for which timing information is provided in the upper panel. The terminator for the middle of the eclipse is not plotted for the sake of clarity.

The unshaded area indicates the region of the Earth from which all the eclipse is visible whereas the darkest shading indicates the area from which the eclipse is invisible. The different shades of gray indicate regions where the Moon is either rising or setting during the principal phases of the eclipse. The Moon is rising on the left hand side of the diagram after the eclipse has started and is setting on the right hand side of the diagram before the eclipse ends. Labels are provided to this effect.

Symbols are plotted showing the locations for which the Moon is in the zenith at the principal phases of the eclipse. The points at which the Moon is in the zenith at P1 and P4 are denoted by (+), at U1 and U4 by (⊙) and at U2 and U3 by (⊕). These symbols are also plotted on the upper panel where appropriate. The value of ΔT used for the calculation of the eclipse circumstances is given below the diagram. Country boundaries are also provided to assist the user in determining the visibility of the eclipse at a particular location.

I. – Total Eclipse of the Sun, 2015 March 20

CIRCUMSTANCES OF THE ECLIPSE

Universal Time of geocentric conjunction in right ascension, March 20^d 10^h 17^m 05^s.134
Julian Date = 2457101.9285316420

		UT			Longitude	Latitude
		d	h	m	°	'
Eclipse begins	March	20	7	40.8	– 23 12.8	+20 13.8
Beginning of southern limit of umbra		20	9	09.6	– 45 13.4	+51 49.6
Beginning of center line; central eclipse begins		20	9	12.7	– 45 58.1	+53 37.5
Beginning of northern limit of umbra		20	9	16.1	– 46 47.9	+55 36.5
End of northern limit of umbra		20	10	14.8	– 53 15.9	+88 35.8
Central eclipse at local apparent noon		20	10	17.1	+ 27 37.3	+85 06.2
End of center line; central eclipse ends		20	10	18.2	+ 97 49.4	+89 22.7
End of southern limit of umbra		20	10	21.2	+111 36.4	+87 37.1
Eclipse ends		20	11	50.2	+ 94 03.9	+56 06.1

BESSELIAN ELEMENTS

Let $t = (UT - 7^h) + \delta T / 3600$ in units of hours.

These equations are valid over the range $0^h625 \leq t \leq 5^h008$. Do not use t outside the given range, and do not omit any terms in the series.

Intersection of the axis of shadow with the fundamental plane:

$$\begin{aligned} x &= -1.81860952 + 0.55345790 t + 0.00008944 t^2 - 0.00000935 t^3 \\ y &= +0.40607424 + 0.17889266 t - 0.00002789 t^2 - 0.00000293 t^3 \end{aligned}$$

Direction of the axis of shadow:

$$\begin{aligned} \sin d &= -0.00454669 + 0.00028062 t - 0.00000029 t^2 + 0.00000003 t^3 \\ \cos d &= +0.99998988 + 0.00000109 t \\ \mu &= 283^\circ09283252 + 15.00440865 t + 0.00000113 t^2 - 0.00000007 t^3 - 0.00417807 \delta T \end{aligned}$$

Radius of the shadow on the fundamental plane:

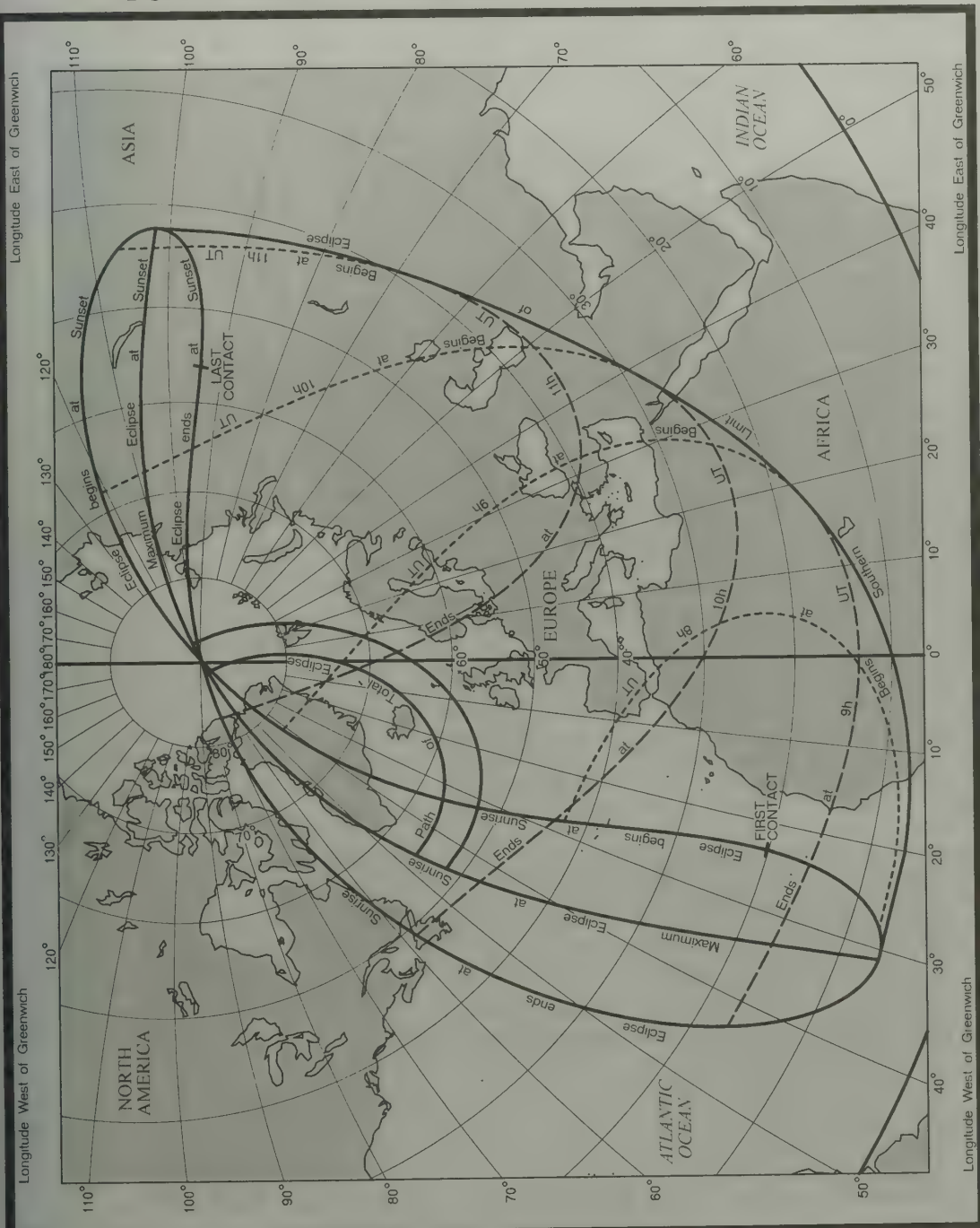
$$\begin{aligned} \text{penumbra } (l_1) &= +0.53575955 + 0.00010415 t - 0.00001314 t^2 + 0.00000002 t^3 \\ \text{umbra } (l_2) &= -0.01057289 + 0.00010315 t - 0.00001286 t^2 \end{aligned}$$

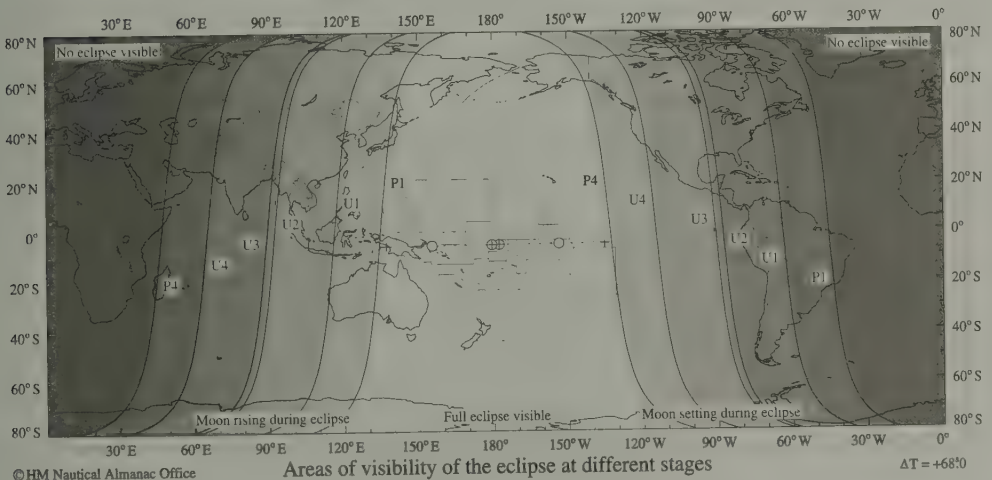
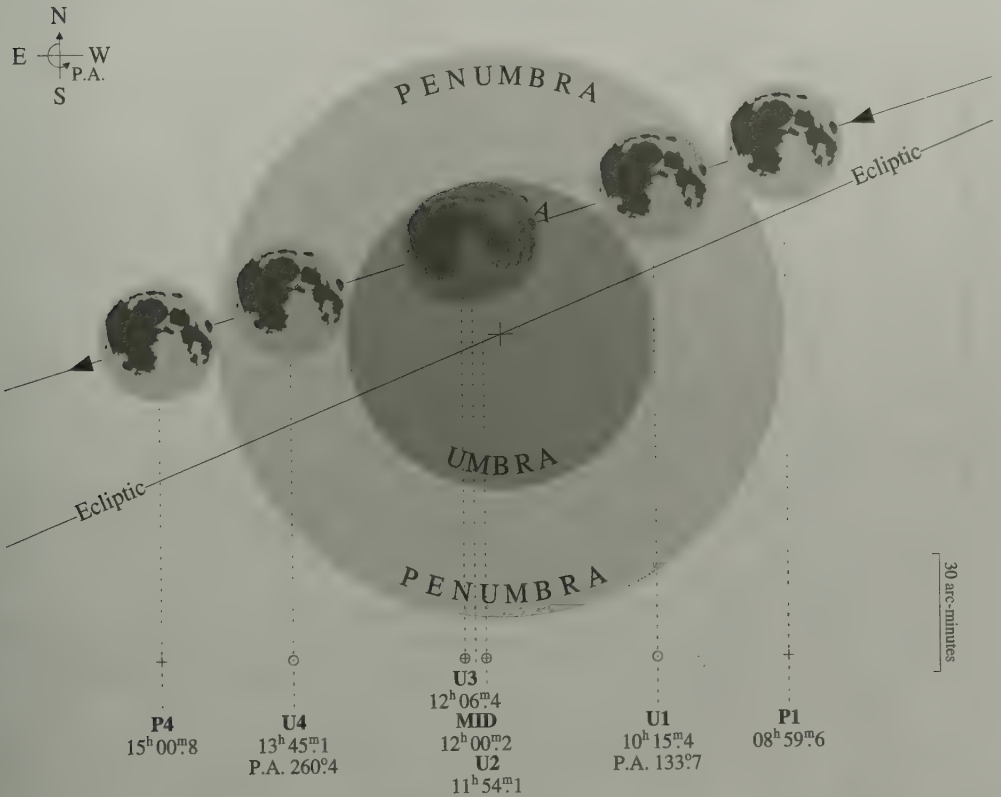
Other important quantities:

$$\begin{aligned} \tan f_1 &= +0.004695 \\ \tan f_2 &= +0.004672 \\ \mu' &= +0.261876 \text{ radians per hour} \\ d' &= +0.000280 \text{ radians per hour} \end{aligned}$$

All time arguments are given provisionally in Universal Time, using $\Delta T(A) = 68^s.0$.

TOTAL SOLAR ECLIPSE OF 2015 MARCH 20



II. - Total Eclipse of the MoonUT of geocentric opposition in RA: April 4^d 11^h 44^m 7^s.552**2015 April 04**
Umbral magnitude of the eclipse: 1.006

III. –Partial Eclipse of the Sun, 2015 September 13

CIRCUMSTANCES OF THE ECLIPSE

Universal Time of geocentric conjunction in right ascension, September 13^d 07^h 35^m 18^s.140
Julian Date = 2457278.8161821710

		UT			Longitude	Latitude
		d	h	m	° /	° /
Eclipse begins	September	13	4	41.7	+ 20 38.5	–27 11.7
Greatest eclipse		13	6	54.2	– 2 16.6	–72 12.8
Eclipse ends		13	9	06.4	+125 07.2	–62 02.6

Magnitude of greatest eclipse: 0.7876

BESSELIAN ELEMENTS

Let $t = (UT-4^h) + \delta T/3600$ in units of hours.

These equations are valid over the range $0^h.625 \leq t \leq 5^h.275$. Do not use t outside the given range, and do not omit any terms in the series.

Intersection of the axis of shadow with the fundamental plane:

$$\begin{aligned} x &= -1.72994733 + 0.48198835\,t + 0.00004997\,t^2 - 0.00000540\,t^3 \\ y &= -0.60881422 - 0.15190990\,t + 0.00000810\,t^2 + 0.00000163\,t^3 \end{aligned}$$

Direction of the axis of shadow:

$$\begin{aligned} \sin d &= +0.06865336 - 0.00027091\,t - 0.00000001\,t^2 \\ \cos d &= +0.99764064 + 0.00001855\,t - 0.00000001\,t^2 \\ \mu &= 240^{\circ}.96131070 + 15.00484777\,t + 0.00000003\,t^2 + 0.00000003\,t^3 - 0.00417807\,\delta T \end{aligned}$$

Radius of the shadow on the fundamental plane:

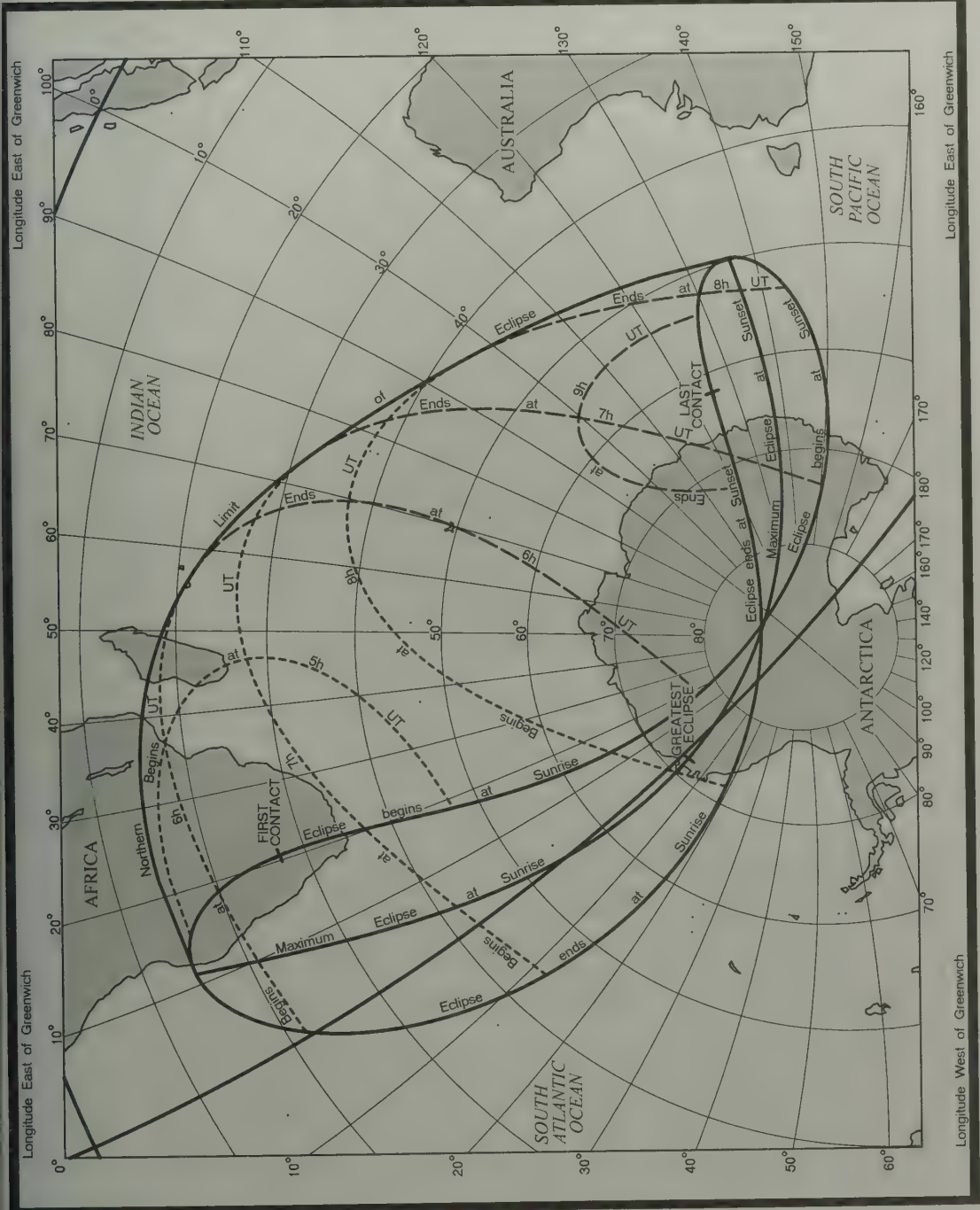
$$\text{penumbra } (l_1) = +0.56812267 + 0.00008417\,t - 0.00000983\,t^2 + 0.00000001\,t^3$$

Other important quantities:

$$\begin{aligned} \tan f_1 &= +0.004647 \\ \mu' &= +0.261884 \text{ radians per hour} \\ d' &= -0.000272 \text{ radians per hour} \end{aligned}$$

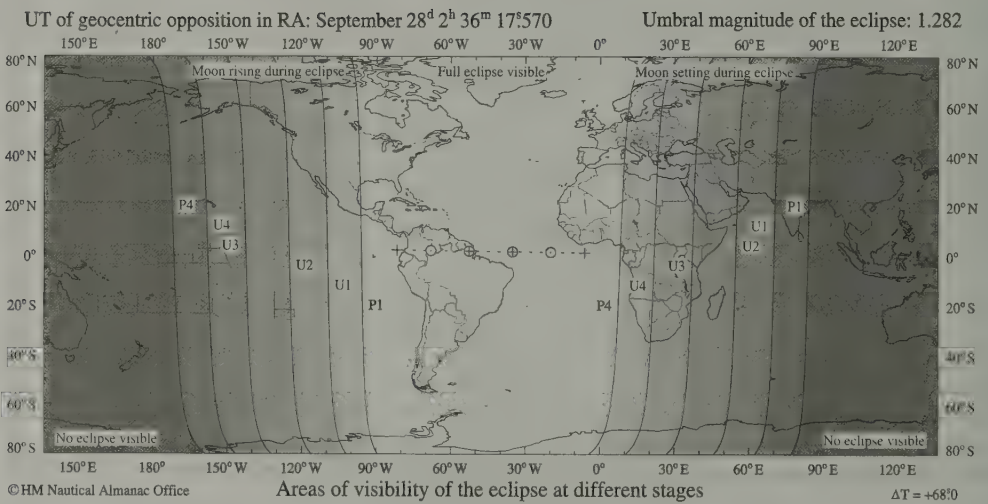
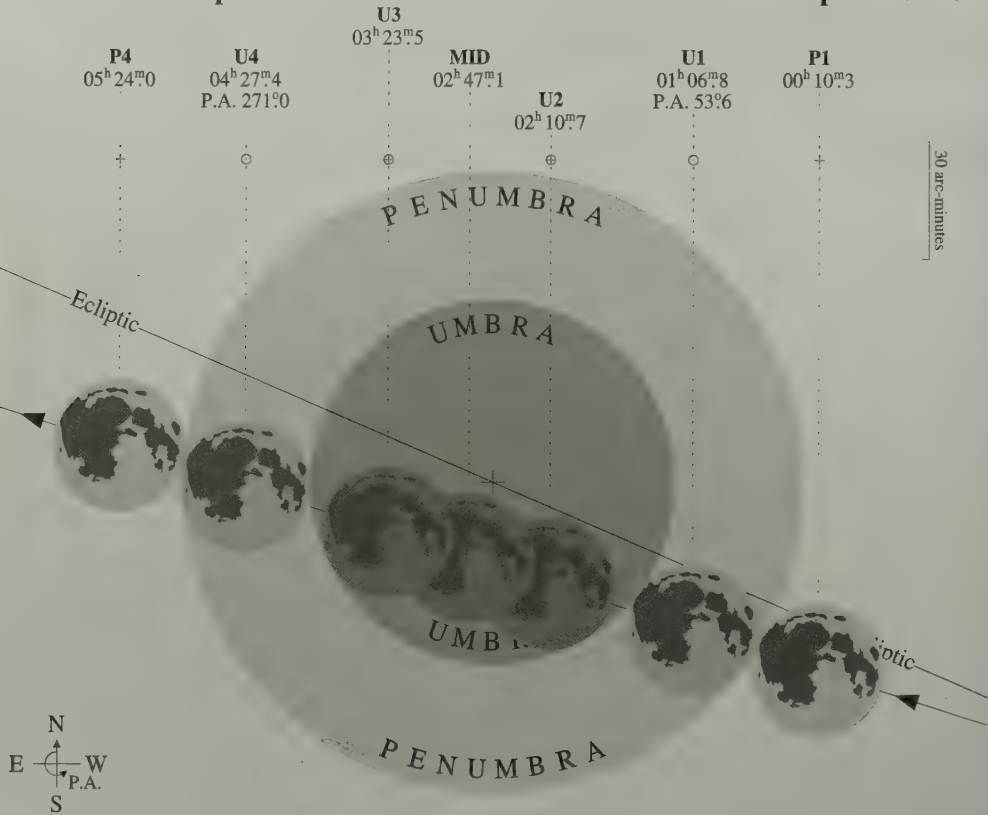
All time arguments are given provisionally in Universal Time, using $\Delta T(A) = 68^s.0$.

PARTIAL SOLAR ECLIPSE OF 2015 SEPTEMBER 13



IV. - Total Eclipse of the Moon

2015 September 28



Joint publications of HM Nautical Almanac Office (UKHO) and the United States Naval Observatory

These publications are published by and available from, UKHO Distributors, and the Superintendent of Documents, U.S. Government Printing Office (USGPO) except where noted.

The Astronomical Almanac (AsA) and *The Astronomical Almanac Online* (AsA Online) contain ephemerides of the Sun, Moon, planets and their natural satellites, as well as data on eclipses and other astronomical phenomena. The AsA is an annual volume while AsA Online is updated annually. The data are calculated cooperatively by the British and American offices. A full list of contributors is given on page vii of the AsA and on AsA Online. (UKHO GP100)

The Nautical Almanac contains ephemerides at an interval of one hour and auxiliary astronomical data for marine navigation. (UKHO NP314)

The Air Almanac contains ephemerides at an interval of ten minutes and auxiliary astronomical data for air navigation. This publication is now distributed solely on CD-ROM and is only available from USGPO.

Other publications of HM Nautical Almanac Office (UKHO)

The Star Almanac for Land Surveyors (NP321) contains the Greenwich hour angle of Aries and the position of the Sun, tabulated for every six hours, and represented by monthly polynomial coefficients. Positions of all stars brighter than magnitude 4.0 are tabulated monthly to a precision of $0^s.1$ in right ascension and $1''$ in declination. A CD-ROM is included which contains the electronic edition plus coefficients, in ASCII format, representing the data.

NavPac and Compact Data for 2011–2015 (DP330) contains software, algorithms and data, which are mainly in the form of polynomial coefficients, for calculating the positions of the Sun, Moon, navigational planets and bright stars. It enables navigators to compute their position at sea from sextant observations using an IBM PC or compatible for the period 1986–2015. The tabular data are also supplied as ASCII files on the CD-ROM. The website <http://www.hmnao.com/nao/navpac> provides a home for issues related to NavPac.

Planetary and Lunar Coordinates, 2001–2020 provides low-precision astronomical data and phenomena for use well in advance of the annual ephemerides. It contains heliocentric, geocentric, spherical and rectangular coordinates of the Sun, Moon and planets, eclipse maps and auxiliary data. All the tabular ephemerides are supplied solely on CD-ROM as ASCII and Adobe's portable document format files. The full printed edition is published in the United States by Willmann-Bell Inc, PO Box 35025, Richmond VA 23235, USA.

Rapid Sight Reduction Tables for Navigation (AP3270 / NP303), 3 volumes, formerly entitled *Sight Reduction Tables for Air Navigation*. Volume 1, selected stars for epoch 2015.0, containing the altitude to $1'$ and true azimuth to 1° for the seven stars most suitable for navigation, for all latitudes and hour angles of Aries. Volumes 2 and 3 contain altitudes to $1'$ and azimuths to 1° for integral degrees of declination from $N29^\circ$ to $S29^\circ$, for relevant latitudes and all hour angles at which the zenith distance is less than 95° providing for sights of the Sun, Moon and planets.

The UK Air Almanac (AP1602) contains data useful in the planning of activities where the level of illumination is important, particularly aircraft movements, and is produced to the general requirements of the Royal Air Force. It may be downloaded from the website <http://astro.ukho.gov.uk/nao/publicat/ukaa.html>

NAO Technical Notes are issued irregularly to disseminate astronomical data concerning ephemerides or astronomical phenomena.

Other publications of the United States Naval Observatory

Astronomical Papers of the American Ephemeris[†] are issued irregularly and contain reports of research in celestial mechanics with particular relevance to ephemerides.

U.S. Naval Observatory Circulars[†] are issued irregularly to disseminate astronomical data concerning ephemerides or astronomical phenomena.

U.S. Naval Observatory Circular No. 179, The IAU Resolutions on Astronomical Reference Systems, Time Scales, and Earth Rotation Models explains resolutions and their effects on the data (see Web Links).

Explanatory Supplement to The Astronomical Almanac, (3rd edition). This book is an authoritative source on the basis and derivation of information contained in *The Astronomical Almanac*. It contains material that is relevant to positional and dynamical astronomy and to chronology. The publication is a collaborative work with authors from the U.S. Naval Observatory, H.M. Nautical Almanac Office, the Jet Propulsion Laboratory, and others. This edition is published by and available from University Science Books, whose UK distributor is Palgrave Macmillan.

MICA is an interactive astronomical almanac for professional applications. Software for both PC systems with Intel processors and Apple Macintosh computers is provided on a single CD-ROM. *MICA* allows a user to compute, to full precision, much of the tabular data contained in *The Astronomical Almanac*, as well as data for specific times and locations. All calculations are made in real time and data are not interpolated from tables. *MICA* is a product of the U.S. Naval Observatory; it is published by and available from Willmann-Bell Inc. The latest version covers the interval 1800-2050.

[†] Many of these publications are available from the Nautical Almanac Office, U.S. Naval Observatory, Washington, DC 20392-5420, see Web Links on the next page for availability.

Publications of other countries

Apparent Places of Fundamental Stars is prepared by the Astronomisches Rechen-Institut, Heidelberg (www.ari.uni-heidelberg.de). The printed version of APFS gives the data for a few fundamental stars only, together with the explanation and examples. The apparent places of stars using the FK6 or Hipparcos catalogues are provided by the on-line database ARIAPFS (www.ari.uni-heidelberg.de/ariapfs). The printed booklet also contains the so-called '10-Day-Stars' and the 'Circumpolar Stars' and is available from Verlag G. Braun, Karl-Friedrich-Strasse, 14-18, Karlsruhe, Germany.

Ephemerides of Minor Planets is prepared annually by the Institute of Applied Astronomy (www.ipa.nw.ru), and published by the Russian Academy of Sciences. Included in this volume are elements, opposition dates and opposition ephemerides of all numbered minor planets. This volume is available from the Institute of Applied Astronomy, Naberezhnaya Kutuzova 10, St. Petersburg, 191187 Russia.

Electronic Publications

The Astronomical Almanac Online: The companion publication of *The Astronomical Almanac*, providing data best presented in machine-readable form. It typically does not duplicate the data from the book. It does, in some cases, provide additional information or greater precision than the printed data. Examples of data found on *The Astronomical Almanac Online* are searchable databases, eclipse and occultation maps, errata found in the printed publication, and a searchable glossary. It is available at

<http://asa.usno.navy.mil> —  — <http://asa.hmnao.com>

Please refer to the relevant World Wide Web address for further details about the publications and services provided by the following organisations.

U.S. Naval Observatory

- Astronomical Applications at <http://aa.usno.navy.mil>
- *USNO Circular 179* at http://aa.usno.navy.mil/publications/docs/Circular_179.php
- USNO Calendar date to Julian date conversion at
<http://aa.usno.navy.mil/data/docs/JulianDate.php>
- NOVAS: Naval Observatory Vector Astrometry Software at
<http://aa.usno.navy.mil/software/novas/>
- *The Astronomical Almanac Online*—~~WWW~~— at <http://asa.usno.navy.mil>

H.M. Nautical Almanac Office

- General information at <http://www.ukho.gov.uk/HMNAO/>
- *The Astronomical Almanac Online*—~~WWW~~— at <http://asa.hmnao.com/>
- Eclipses Online at <http://astro.ukho.gov.uk/eclipse/>
- Online data services at <http://astro.ukho.gov.uk/websurf/>
- MoonWatch at <http://astro.ukho.gov.uk/moonwatch/>

International Astronomical Organizations

- IAU: International Astronomical Union at <http://www.iau.org>
- IERS: International Earth Rotation and Reference Systems Service at <http://www.iers.org>
- SOFA: IAU Standards of Fundamental Astronomy at <http://www.iausofa.org>
- NSFA: IAU Working Group on Numerical Standards at <http://maia.usno.navy.mil/NSFA>
- CDS: Centre de Données astronomiques de Strasbourg at <http://cdsweb.u-strasbg.fr>

Publishers and Suppliers

- The UK Hydrographic Office (UKHO) at <http://www.ukho.gov.uk>
- U.S. Government Printing Office (USGPO) at <http://bookstore.gpo.gov>
- University Science Books at <http://www.uscibooks.com>
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